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ABSTRACT

Presented is a compilation of teaching resources prepared by teachers enrolled in a graduate-level environmental education course at California State University, Hayward. The emphasis of these materials is upon agriculture and related environmental practices in California's San Joaquin Valley. Following a description of course logistics are six chapters containing background information and activity suggestions which deal with: (1) factors that influence crop growth, (2) Caswell Memorial State Park, (3) food preparation, (4) history of farming, (5) history of San Joaquin County, and (6) field trips and speakers. The outdoor learning experiences recommended are designed for use in a variety of subject areas. (WB)

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FOOD & ENVIRONMENT

A TEACHERS' RESOURCE GUIDE TO CALIFORNIA VALLEY AGRICULTURE

Compiled by Esther Railton, Ed.D.

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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FOOD AND ENVIRONMENT

Compiled by Esther P. Railton, Ed.D.

Copies are available at cost from
The Environmental Education Laboratory, Department of Teacher Education
California State University, Hayward, California 94592

Publication date, 1980.

PREFACE

This curriculum guide was prepared by a graduate class in Teacher Education (6417 Field Studies in Environmental Education), offered by California State University, Hayward in 1978. The purpose of the class was for a group of metropolitan teachers to learn firsthand about agriculture, focusing on the Central Valley of California. The premise was that agriculture is a basic industry to world survival and to the socioeconomics of the United States. Therefore, the class was concerned about environmental practices. This guide presents the research performed and suggestions proposed for curriculum integration for grades K-14.

The Guide was complied by the instructor Esther P. Railton, and published by an Energy Environmental Education Grant from the California Department of Education funded through the sale of personalized license plates. The illustrations are by Richard L. Railton.

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SYLLABUS

PARTICIPANTS*

Wun-Ping Ma (Elizabeth Peoples), North Michigan, Michigan
Toris A. Jaeger, Oakland, CA
Anna L. McGuire, Tracy, California
Edward C. Simons, Steve Simons, Brentwood
Maxine Burnworth, Concord
Esther Railton, Ed. D., Professor of Teacher Education, Cal State Hayward
Delcye B. Bailey, Emeryville
Charles S. Mayer
Tammy Mayer, Oiyhee, Nevada
Keiko Kochi Aresh, Manitoba, Saskatchewan
Carol Place, Vergennes, Vt.
Melva Rush, Lisa Hahn, Hayward, CA
Michael Tucker, Grass Valley
Ed Railton, Walnut Creek

* All of the participants were from the San Francisco Bay area, but some have married and several have moved.

VISITORS

Ruth Merrill, Caroline Pratt, and daughter, Davis
Ross McGinnis
Molly McGinnis
Bob and Chris Brocchini and family
Elizabeth Sallmann and her two guests from Switzerland
Erva Dyke
Greg, Mary and Jonathan Sky Gordon
Edward Carmo
Wayne Peoples
Linda Tucker
Marion and Jonathon Mayer
Ed Place
Mickey and Cory McGuire
Marilyn and Tammy Simons

RESOURCES

C. W. Martin, Manager
Caswell Memorial State Park
28000 S. Austin Road
Rippon, California 95366
(209) 599-3810

Tom Holmes Director
Contra Costa Conservation District
Concord, CA 94521

Dairy
Ed Machado
Melton Road
Ripon, CA 95366

Solar house and goat farm
Elizabeth Sallmann
98858 East Louise
Manteca, CA 95336

Family Farm
Sam, Molly and Ross McGinnis
9699 Melton Rd.
Ripon, CA 95366

San Joaquin River Club
Erva Dyke
16725 McKinley, P.O. Box 171
Lathrop, CA 95330

U.S. Dept of Interior
Bureau of Reclamation
Delta Pumping Plant
Kent Heidt, guide
John Meyer
Tracy, CA 95376

den Dulk Poultry Farms
Post Office Box 698
Ripon, CA 95366
Wayne Graves, Wanda

Eve Baldocchi
Walnuts
Sellers Avenue
Rt. 2. Box 187
Oakley, CA 94561

Veale Tract Farms
John Mass
P.O. Box E.
Knightson, CA 94548

Wedron Silica Plant
Camino Diablo Rd.
Byron
(415) 634-3575

Albert and Bob Brocchini
Row Crop Farm
2701 Austin Rd.
Ripon, CA 95366

Fisher Nursery
Jerry Fisher
P.O. Box 655
24080 Austin Rd.
Ripon, CA 95366
(209) 599-3412

USDA Soil Conservation Service
Kirby McClellan
1313 West Robinhood Dr. Suite 8
Stockton, CA 95207
(209)946-6229

C & B Farm Equipment
Frank Coelho
8901 W. Velma Lane
Tracy, CA 95376

Spreckles Sugar Refinery
Mr. Boyden, Mr. David Voit
Manteca, CA 95336

RESOURCES (Continued)

Boy Scouts of America
Troup 425
Vahl Clemensen, leader
672 Sandalwood
Manteca, CA 95336

Women for Agriculture
California, Chris Brocchini
P.O. Box 506
Ripon, CA 95366

Dr. Stephen Wilhelm
Professor of Plant Pathology
University of California
Berkeley, CA 94704

Future Farmers of America
Tracy High School
Tracy, CA 95376

R. F. Lyons Co. Insurance
P.O. Box 10120
Santa Ana, CA 92711

Oregon Women for Agriculture
Andrae Hofman, State Edu. Chr.
Serenity, Oregon

Oregon Seed Council
2110 Lancaster Drive, N.E.
Salem, Oregon 97303
(David Nelson, Exec. Sec.)

San Joaquin County Supt. of Schools
Leonard Beeman, Science and C.E.
Courthouse Room 406
222 East Weber Ave.
Stockton, CA 95202

U.S. Dept. of Agriculture
Consumer Information Dept.
Washington, D.C. 20004
(202) 447-3299

FILMS

Food from Farm to You (16mm)
Farm Film Foundation
1425 H St., N.W.
Washington, D.C. 20005
(other films available)

Conservation is Where You Find It, slide/tape
Soil Conservation Soc.
(local soil cons. dist.)

NOVA, video tape
The Insect Alternative
The TseTseFly
Channel 9

USDA People on the Farm
3 case studies.h.s.

Bullfrog Films, Inc.
Oley, PA 19547
(215) 779-8226
A Sense of Humus, 28 min. sound/color
Potatoes, 28 min. sound/color
Looking for Organic America 28 min, s/c

Farther Than the Eye Can See
Holly Sugar Corporation
P.O. Box 1052
Colorado Springs, Colo. 80901
17 min. sound/color

HOLD HARMLESS AGREEMENT

June 23, 1978

I voluntarily enrolled in T Ed 6417, Field Student in Environmental Education. Although this course is in the Environmental Education Sequence, I realize that there are alternative ways to obtain a Master's Degree in Curriculum.

The field study involves commuting on freeways and farm roads. The course involves a week of outdoor living in Caswell Memorial State Park. Some voluntary recreation will include use of the Stanislaus and perhaps the San Joaquin rivers, which are high. Some instructional activities will take place on the river banks. The park has mosquitoes, stinging nettles and poison oak. Farmers will be using pesticides and herbicides on the fields that we visit. The sun will be near the zenith.

I have read the above, understand the risks and wish to be involved in the course. I will not hold California State University, Hayward, the California State Park and Recreation System, the private and corporate landowners we visit, the approved driver, or the instructors responsible for actions of my own. I agree to observe and abide by directions.

Signed_____

Date_____

BUDGET

T. Ed. 6417 Caswell State Park June 26-30, 1978

Income	
Fees	
15 Participants at $16.00 ea.	$240.00
1 Guest at $10.00	10.00
1 Donation $25.00	25.00
	$275.00
Expenses	
(Food, supplies, park fee)	- 272.73
Balance	$ 2.27

CALENDAR

June 19 Film: "Lettuce--Field to Market" Goals Planning Reviewing agricultural materials	20 Field trip to Brocchini Ranch and Caswell Memorial State Park	21 Films: "Potatoes" "Organic Farming" Planning schedule Organizing curriculum guide	22 Field trip with Tom Holmes, Soil Conservation District Director Byron Sand Quarry Baldocchi Walnut Orchard Mass Soil Reclamation Project	23 NOVA videotapes: "Pesticides" "The TseTse Fly" Gathering materials and getting ready for camp
June 25 Delta Water Pumping Station and Fish Retrieval Station Setting up camp at Caswell Park Seed sprouting Killing and dressing chicken Pioneer dinner Campfire	26 McGinnis family farm Machado dairy Water recreation Oriental dinner Fishing Crafts	27 denDulk Poultry Ranch Sallman's goat farm and solar house Mexican lunch Evening at Erva Dyke's San Joaquin River Club, a reclamation project	28 Fisher's Plant Nursery C & B Farm Machinery supply Lunch at Anna's Spreckles Sugar Refinery Bar-B-Que dinner with guests Campfire	29 Soil Conservation Service: Kirby McClellan Sun Prints Complete crafts Clean-up, pack, return to campus
July 3 Return material Write curriculum	July 4 Holiday	5 U.C. Professor of Plant pathology Steve Wilhelm Work on curriculum	6 Soil studies: G. Mayer Work on curriculum guide	7 Film: "Food from Farm to You" Finish curriculum guide

MENUS FOR CASWELL PARK

	Breakfast	Lunch	Dinner Toris
MONDAY	No Host	Bag Lunch	Barbecued chicken Corn Bread Cabbage Salad Butter & Honey Roasted Corn
TUESDAY	Pancakes Esther Fruit	Trail Lunch Melva Carrot Sticks Celery Sticks Home-made Bread Cookies Cheese Fruit	Asian Cuisine Wun-Ping Keiko Pepper Beef Chinese Chicken Salad Noodle Dish Fruit Walnut Cookies Pita Bread
WEDNESDAY	Scrambled eggs Ed & Charles Sausage Fruit Johnny Cake	Burritos Toris Tortillas Both wheat & corn Jicama Salad Mexican Wedding Cakes Potatoes	At Erva Dyke's Casserole Salad Cake
THURSDAY	Cooked cereal Mike 7 grain Dry cereal Fruit Omelet	Tuna sandwiches Delsey Fruit	Celebration Shishkebab Fried Onions Sassafrass Tea Home-made ice cream No-bake cookies Potatoes
FRIDAY	Maxine LEFTOVERS Omelet	LEFTOVERS Watermelon	ON YOUR OWN

THE SUPPLIES LIST FOR COOKING AND CRAFTS

The supplies list for an experience of this kind can be put together by the entire group or committees. It will depend on the goals and objectives that the group plans to accomplish. The following list covers supplies needed for cooking and the craft activities.

A. Cooking

2 large heads of green cabbage
1 large jicama
7 lbs. oranges
2 cucumbers
5 lbs. tomatoes
2 heads lettuce
3 lbs. carrots
2 large green heads cabbage
1 bag potatoes
4-1/2 to 5 lb. ground beef
5 lbs. stewing meat
2 lbs. pork
1 lb. Monterey Jack cheese
2 quarts half and half
1 box dehydrated milk
or 1 gallon milk
1 jar instant coffee
6 doz. eggs
1 can lighter fluid
1 roll wax paper
1 roll aluminum foil
3 rolls paper towels
4 lbs. rock salt
1 can black pepper
5 lbs. white flour
2-10 lbs. corn meal
1 container of baking powder
1 can shortening
1 jar vinegar (cider)
1 package root beer starter
1 can oregano
1 bottle pancake syrup
1 jar mayonnaise
1 jar honey
1 container of baking soda
2 lbs 7 grain cereal (Co-op or health food store)
1 egg beater
2 sets of measuring spoons
4 large knives
1 dutch oven
2 large pans (washing dishes)
4 cookie sheets

50 lbs onions (donated)
5 lbs. apples
3 lbs. bean sprouts
22 large bell peppers
1 lb. mushrooms
1 stalk celery
5 lbs. apricots
1 red cabbage
55 whole chickens (3&1/2 lbs. fryers)
3 lbs. round steak
4 cans tuna 6-1/2 oz. or 3 cans 9-1/2 oz. cans
1 lb. American cheddar cheese
1/2 pint sour cream
2 quarts buttermilk
5 pints whipping cream(not sterilized)
1 box tea
1 gallon apple juice
4-10 lb. pkgs. charcoal (or wood)
1 box matches
1 roll saran wrap
1 large package paper plates
1 large package napkins
1 bottle of dishwashing liquid
5 lbs. wheat flour
10 lbs. of sugar
1 container of salt
1 jar of cooking oil
1 bottle vanilla
2 bottles root beer extract
1 bottle lemon juice
1 can celery seed
1 bottle soy sauce
1 bottle Italian dressing
1 can pineapple
1 box powdered sugar
2 frying pans
4 mixing bowls
4 measuring cups
4 mixing spoons
1 can opener
1 wire whisk
2 rolling pins
3 sauce pans

THE SUPPLIES LIST FOR COOKING AND CRAFTS (Continued)

A. Cooking

1 cork screw
2 ladles
2 frying pans
2 clothes hangers
2 ice cream makers
2 peelers
1 egg beater
4 mixing cups

B. Household and other related crafts

Candle wax
1 ball string for candle wicks
4 coffee cans
1 stove or Coleman burner
2 packages of corn husks
styrofoam balls (one per person)
pipe cleaners (one per person)
1 ball of string
2 packages of straight pins
felt tip pens (assorted colors)
4-5 pairs of scissors
material scraps: both small & large (enough for 2 activities)
leather scraps
2 or 3 sets of sewing needles

Please note: You will want to add to this list depending on the crafts that will be included.

Toris Jaeger

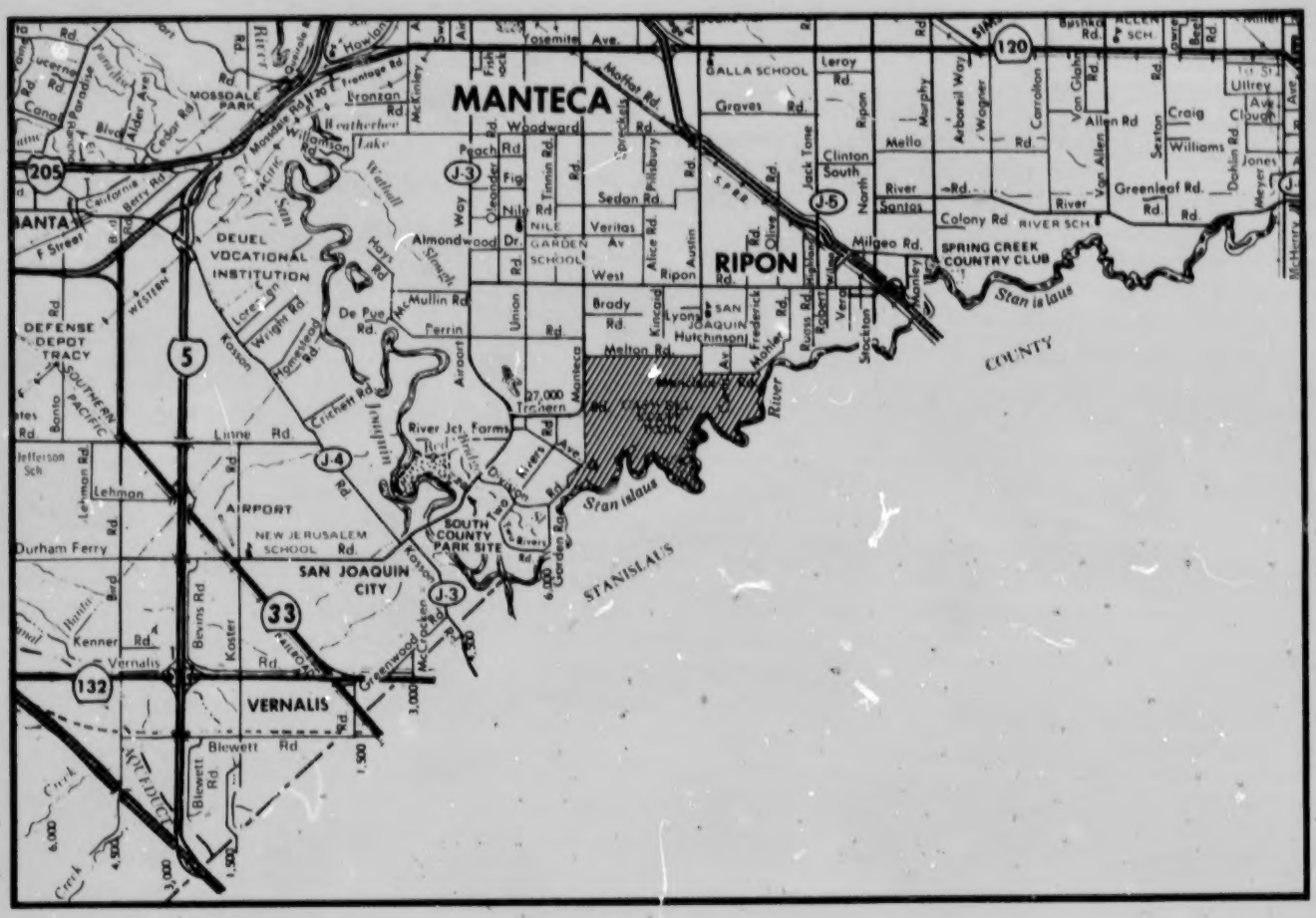
EQUIPMENT LIST

Personal

1 pair jeans or slacks or pant suits (wash and wear)
  shorts ok
light shirt or knit top, 1 long sleeved
sun hat and dark glasses
1 cardigan sweater
swim suit
raincoat or poncho
hiking boots optional
low heeled or tennis shoes
heavy socks, cotton or wool
pajamas?
light cotton underwear
sleeping bag or bedroll, mosquito netting
towel, soap
toothbrush, paste
brush, comb
cosmetics (include talcum powder and skin freshener)
sunscreen, insect repellent

Optional

camera, film
hand lens
flashlight
pillow
pen knife
pocket guides to natural history
notepad, pencils
musical instruments
recording tape, recorder
portable typewriter
binoculars


MANTECA
RIPON
DEUEL VOCATIONAL INSTITUTION
DEFENSE DEPOT TRACY
SOUTHERN PACIFIC
AIRPORT
SAN JOAQUIN CITY
VERNALIS
SOUTH COUNTY PARK SITE
SPRING CREEK COUNTRY CLUB
Stanislaus
COUNTY
STANISLAUS
Yosemite Ave.
Woodward
Peach Rd.
Fig
Nile Rd
Sedan Rd.
Veritas
Brady Rd.
Melton Rd.
Union Rd.
Manteca
Austin Rd.
Ripon
Graves Rd.
Leroy Rd.
Clinton
South
River
Santos
Colony Rd
Milgeo Rd.
Jack Tone
Ripon
Murphy
Arboreal Way
Wagner
Carrolton
Allen Rd
Craig
Williams
Greenleaf Rd.
Serton
Van Allen
Dahlin Rd
Jones
Ullrey
Ave
Cloud
Meyer
Mello
Monterey
Stockton
Burns Rd.
Roberts
Vera
Frederick
Lyons
Hutchinson
SAN JOAQUIN
Kingsley
Alice Rd.
Pillsbury
Timmon Rd.
Oleander
Almondwood Dr.
GARDEN SCHOOL
Mc Mullin Rd
Ferrin
De Pue Rd.
Hayes Rd
Wright Rd.
Lone Jen
Roseswood Rd
Crichett Rd
Lone Rd.
Jefferson Sch
Lehman
Lehman Rd.
Durham Ferry
NEW JERUSALEM SCHOOL Rd.
Bevins Rd
Koster
Kenner Rd.
Vernalis
Blewett Rd
Blewett Rd.
Monadnock Rd
Trenton Rd.
Howland
Heatherbee
Lake
Williamson
Weatherbee
Mossdale Park
Alder Ave
Cedar Rd
Conan
Parkside
Paradise
Berry Rd
California
Scott
Pacific
Western
Konson
Sloughhouse
Hatch
Airport
Two Rivers
Garden Rd
Greenwood
McCracken
Hunter
Creek
Fairbanks
Mt Eden
Gallo School
Orchard
Fisher
Fairfax
Ave
Sierra
Burkea Rd.
Green Sch
Beard
Rd
Tot St
Ave
Ave
Ave

METHOD FOR OBTAINING STUDENTS

Taking students on an extended field experience requires a large investment of time and effort toward obtaining permission from the district's board of trustees. Briefly, I will outline the steps that facilitated my efforts in obtaining permission. Included are preliminary steps to be taken before submitting a proposal, topics to be covered in a written proposal, and special measures that may ensure passage of the proposal.

Once the theme of the field experience, in this case agriculture, has been decided upon, a proper site for the experience must be chosen. Caswell State Park offered a place for a base camp, and there were farms nearby that could be used to explore agriculture. Next, the length of stay must be established and dates for the experience set. A contact should be made with the superintendent of schools in the district. At that time goals should be explained and the obligations of the district should be discussed. A date can be fixed for the proposal to be made to the board.

The written proposal should include a stated purpose and a brief description of the instructional program. A description of the site stating its location, distance to emergency care, facilities, and transportation plans should be included. The qualifications of the personnel should be listed. Plans for the preparation of food should be included. Finally, a budget should be prepared. The budget should include costs of food, insurance, camp fees, etc.

One should remember that the board of trustees holds the power to grant or deny support for the program. One should also realize that the board members may not be familiar with trends in outdoor education. Therefore, before the board meeting, contact should be made with each member. The program should be explained to each in some detail. This will ensure some familiarity on the part of the board members with the program. Parent and student support in the forms of petitions, letters, phone calls,and board meeting attendance are also valuable assets. Proof of the success of similar programs by the means of slides and speakers reassures the trustees. Finally, be prepared to describe the program publicly at the meeting as well as to answer questions about every aspect of it.

One last word: be willing to alter the program in order to comply with the demands of the board members. They may have valid concerns.

Anna McGuire

FACTORS THAT INFLUENCE CROP GROWTH

SOIL

WATER

PLANTS AND PLANTING

PESTICIDES

ALTERNATIVE FORMS OF ENERGY

SOIL

Soil quality and texture are important factors in determining what crops a farmer can raise. We all walk on soil daily without a second thought as to the complex nature of what is beneath our feet. Not only is soil made up of sand, clay, silt, and gravel, but it also contains a complex world of living organisms that can determine the life or death of the plants and animals that live on its surface. The Australian Science Education Project book titled World of the Soil, copyright State of Victoria, Australia, 1974, includes activities that are designed to acquaint students with this complex ecosystem in a simple and straightforward manner. It is hoped that through the use of these activities we can all become better farmers in our world.

Charles Mayer

SOIL ACTIVITIES

- Collect samples
- Examine through a hand lens
- Look for living things
  - Screen out crawlers and wigglers
  - Identify and draw them
  - Look for decaying things
  - What part do they play in plant nutrition?
- Weigh the soil, dry out the water and weigh again
- Sort particles according to size
- Describe texture, sticky or gritty
- Make model dams of different types of earth
- Compare contour and strip plowing
- Discover different kinds of erosion
  (drip, splash, rill, gully etc. and how to prevent top soil erosion)
- Test for pH, find out how it affects plants

WATER

Agriculture depends on water. "Food and fiber production makes use of at least 85% of California's developed water supply " (California's Environment, No. 32 July-August 1976 , p. 1). Crops must be watered at certain times in order to grow consistently and be ready for harvest at the right time. Additionally, water is used as a carrier for pesticides on crops. In processing of agricultural crops, water is used in great quantities for various reasons.

Farm land is of value only when water is available. The value per acre of land is directly proportionate to the quality and amount of water.

Following are the primary types of irrigation:

Riparian water rights—the land owner has the right to take water from a stream or river directly adjacent to his land.

Irrigation districts—usually cooperatives with canal systems to supply the farmer with water when the irrigation district says the farmer can have the water.

Many farms utilize multiple sources of water for their benefit. In addition, Mother Nature provides varying amounts of rainfall throughout the year.

Delivery systems to the fields and orchards are varied. In flood irrigation, berms of earth are raised and water is allowed to flood a few inches deep. Trench irrigation is where the water is allowed to feed by gravity into the trench and soak into the ground from the trench. The irrigation system that conserves the most water is the sprinkler system. The primary sprinkler type is the Rainbird. Sprinklers are also the most expensive irrigation system.

In the Sacramento-San Joaquin River Delta and the San Joaquin Valley, water is used also in the non-growing season to percolate salts down into the soil to allow for crop root development above the salt. Each year the salt creeps back up in the soil

The future of water of high enough quality for irrigation is questionable. More and more water is being transported by agencies to new areas. These new areas have contracts with the water agencies to deliver quality water. The old areas near the quality water have no contracts nor guarantees of having quality water to irrigate with. Also as cities grow throughout California, more and more sewage wastes are being dumped into the rivers. At the same time more and more non-point-source discharges are going into the water. These discharges add to the total dissolved salt content of the water. The sewage and salts plus other discharges into the waterways result in a degradation of water quality as the water progresses downstream.

New ideas about the use of our treated sewage water are currently evolving. Many people want to use this water to irrigate agricultural lands and recharge diminishing groundwater supplies. The largest problems with this use are public health and the fact that the largest discharges are near the cities rather than the agricultural areas.

RELATED ISSUES

1. Recycling of liquid and solid waste.
2. Investigating new water projects.
3. Investigating health hazards associated with sewage water uses
4. Studying indicator organisms associated with the varying degrees of water pollution.

ACTIVITIES

1. Build and maintain a weather station.
   a. Study rainfall, the source of our water.
   b. Study other weather conditions which affect crops.
2. Determine the force and volume of stream flow, canal flow, or ditch flow.
   a. Calculate cubic feet per second in a supply ditch.
   b. Determine how much water would be needed to give one acre foot of water.
3. Raise potted farm plants. Keep accurate records of water used. From results, compute water requirements per acre in inches, gallons, and acre-feet.

SOURCES

Activities 1 and 2 are from Teaching Science in an Outdoor Environment, Phyllis Gross and Esther P. Railton, Berkeley: University of California Press, 1972.

Activity 3 is from Michigan Department of Conservation, Education Division, Water--An Activities Outline for Use in Schools, p. 2-D.

Edward Simons

PLANTS AND PLANTING

There are many reasons for urging people to grow their own vegetables. Plants produce oxygen. They are the only source of oxygen this planet has. Every time you add a green plant to your surroundings you are adding to the healthful source of your own life. Conversely, every time that you drive to the store to buy your vegetables you are adding very significantly to air pollution: not just the car you drive, but, just as important, the truck that transports the vegetables from farm to store is sending lead, hydrocarbons, carbon monoxide, and other deadly poisons into the air. The farther a vegetable has to travel from the ground to your table, the more it will cost you in cash, pollution, and also in taste!

Most vegetables start changing their delectable sugars to starches the minute they are picked. For instance, to get the most out of sweet corn it is best to have the pot of hot water all ready before the corn is picked, so barely a minute passes. If your idea of what a tomato or a beet tastes like is based on the samples bought in your supermarket, you don't really know what gourmet fare these vegetables can be.

Furthermore, the most luscious varieties of table vegetables are frequently the very ones that must be eaten fresh-picked and will not stand up under the mechanical harvesting and the extensive shipping and handling that the varieties grown commercially must endure. These "taste sensations" are often available to you only if you grow them yourself.

The final, excellent reason for growing your own is that you can raise your own vegetables without resorting to the use of the long-lasting synthetic pesticides. By practicing the latest organic gardening techniques, keeping a balance of many insects around and growing only small amounts of each kind of vegetable, you can prevent insect epidemics from developing.

Choose some vegetable that is easy to grow, that you enjoy eating, and that is suited to your area and the time of the year (many kinds of winter vegetables can be grown in the Bay Area). Precise information is available in a number of different places. The Vegetable Garden Book, published by Sunset, and Minigardens for Vegetables, Department of Agriculture Home and Garden Bulletin #163, are good ones to start with. These books will give you information on just which plants can be grown in a 6-inch container (e.g., beets, lettuce, radishes, etc.), a 12-inch box (e.g., chard, carrots, tomatoes, etc.) and an 18-inch deep tub (almost anything) as well as how to plan a larger garden on a small plot of ground.

Because of the tempering effect of the Bay on the climate, we here in the Bay Area are very fortunate in being able to grow three plantings a year. If among these we include some of the vegetables that can continue to be harvested over a long period of time (such as chard, broccoli, leaf lettuce, parsley, etc.), then there need not be a single month of the year without gardens contributing to the health and delight of your family and environment!

SOURCE

Adapted from "Victory Gardens" (reprint) by Helga Olkowski.

The following pages will describe activites based in large part on the foregoing philosophy, suitable for getting children interested in growing their own plants and garden vegetables.

GARDENING FOR KIDS or GROW YOUR OWN

All plants need soil, air, light, and water. You can buy basic potting mix in supermarkets and nurseries. If you really want to mix your own soil, here is a basic recipe:

Basic Potting Mix

equal parts (packaged potting mix
(peat moss
(sand (not ocean sand)* or perlite

* salt from ocean sand will kill plants

SEEDS IN SOIL

1. Save seeds from apples, oranges, squashes, anything with seeds. Soak them in water overnight.
2. Plant them in a shallow pan (an egg carton will do). Line the bottom with small pebbles. Put in 1½ inches of soil. Plant the seeds ¼ inch deep and 1 inch apart.
3. Moisten the soil and cover the carton with a plastic bag to keep in the water. Put it in a sunny, warm place.
4. In a week or so you should see some seedlings. When they are an inch or so high, move them to larger pots.

GARLIC PLANT

1. Put 3-4 unpeeled cloves of garlic in soil at the top of a pot (milk cartons, cottage cheese and yogurt containers are great) with the points of the cloves up. Barely cover the cloves. Water well.
2. Whenever your family needs garlic to season food, just snip off little bits of the plant (like chives) and add them to food. Good garlic flavor. The shoots keep growing, so snip often!

HERBS

1. Herbs are some of the easiest plants to grow! Most herbs grow from seeds (find them in grocery stores, nurseries, or wherever seeds are sold). They can be planted in all kinds of small containers: egg shells, clay pots, peat pots, muffin tins, orange juice cans. Be sure to allow for drainage.
2. To plant herbs, use basic potting soil and containers you like. Cover seeds very lightly with soil. Water well. A good way to water seeds after planting is with a sprayer or mister.

3. To dry herbs, cut off branches you want to use. Wash in cool water. Dry in a warm, dark room (about 70 degrees) for two to three days. Then strip the leaves from the stem. Put each kind of leaf in its own jar, and keep tightly covered.

TOPS

1. The tops of carrots, parsnips, turnips, in fact any root vegetable, will grow handsome green leaves. Cut away all but an inch or two of the root. Save the stem part to eat.
2. Put them in a dish. Keep it filled with about ¼ inch of water. Watch for sprouts.

HANGING GARDENS

1. Use any root vegetable, such as a carrot, turnip, or rutabaga. Cut away about two-thirds of the tip. Scoop out the center section.
2. Poke 3 toothpicks into your vegetable. Hang it with a string in a sunny window.
3. Keep the hole filled with water. Turn your garden occasionally so that the foliage grows evenly.

SPROUTS

1. Buy alfalfa or mung bean seeds at the store. Use two tablespoons of alfalfa seeds or 1/2 cup of mung beans for each quart jar you start.
2. Soak seeds overnight; drain well and put in a jar. Punch a few air holes in the jar lid, then put lid on jar.
3. Set the jar on its side in a warm spot in indirect or no light.
4. Rinse seeds with water once or twice a day to keep mold from forming. Drain well after rinsing.
5. The seeds will sprout in four or five days. If they have not turned green by harvest time, set them in direct sun for a while. Use the sprouts in salads or on sandwiches—yum!

THESE LIKE IT COOL

1. Some nuts and seeds need to be refrigerated before they will grow. They need an "artificial winter" in your fridge.
2. Put peach, apple, or plum seeds (or try almond, walnut, apricot, grape) in a jar in your fridge for six weeks to three months. Turn the jar occasionally.
3. When they sprout, plant them in soil and put them in a sunny window.

SOURCES

Many more interesting ideas can be found in the following two sources;

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Native Edible Fruits, Nuts, Vegetables, Herbs, Spices and Grasses of California

I Fruit Trees and Nuts, March 1975 #2226
II Small or Bush Fruits, November 1975, #2278
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Vegetable Crops: Planting and Harvesting Periods for California. #2282

Melva Rush

FOLLOW-UP ACTIVITIES

REPRODUCTION: SEXUAL AND ASEXUAL

Life cycle of plant: collect and mount samples of the stages in the cycle.
Germinate seed in a cup.
Experiment: Put dry seeds and water in a capped jar.
Field trip: collect seeds, observe adaptations that allow seed to be dispersed.
Root plant cutting in milk carton and plastic bag.

SOILS: SOME SIMPLE EXPERIMENTS

Observe road cuts for topsoil and subsoils.
Separate sand, silt, and clay by mixing in water in a jar.

PLANT GROWTH FACTORS

Record temperature change over 24 hours.
Make a rain gauge and record finding over a long period.
Put plant in sunlight and then in a dark place.
Using several milk cartons, plant seeds at different depths and record results.
Experiment with direction of plant growth.

PLANT CHARACTERISTICS

Mount a sample that shows all parts of plant and label it.
Label parts of a flower after mounting.
Time the rate at which colored water moves up a celery stalk.

GROWING AND USING PLANTS

Put a sweet potato in a glass of water.
Put carrot tops in a shallow dish of water.
Build a terrarium.

SOURCES

Plant science manuals for 4-H members and leaders (available through the county 4-H office or by writing the University of California, Division of Agricultural Sciences) are excellent sources of study activities. Background information is excellent, study guides are thorough and glossaries are included. Exploring the World of Plants and Soils, which is the source of the activities listed on the previous page, contains the following more complex activities as well.

PLANT REPRODUCTION UNIT: The following topics are dealt with in detail.

Cross fertilization. Detailed instructions for crossing two corn plants to breed new plants.

Crossing two cucumbers. In this project, the breeding of two different types leads to the understanding of the genetic concept of dominant and recessive characteristics.

Growing first generation crosses. Detailed project information on how to set up a simple back-cross experiment and record keeping of the results.

Rooting plant cuttings. Simple project to show means of reproducing asexually to give same genetic structure as the parent plant.

Propagation by runners and rootstocks. (Rhizomes grow below the ground, stolons grow above the ground, and runners run along the ground.)

Propagation by tuber. Insures genetic makeup of parent stock (for example potatoes).

Propagation from fleshy roots. The sweet potato demonstrates that reproduction will not take place unless a slip is taken from the plant and transplanted into new soil.

Propagation by bulbs. New bulbs are formed at base of the old bulb.

Starting plants from leaves. A variety of methods are described.

Propagation by layering. Stems placed underground will root.

Grafting. Detailed graphics of this simple process of joining a rootstock to a budstock (scion).

Budding. A form of grafting done after the growing season has ended for new growth.

SOILS UNIT: This unit has more complex projects wherein the students learn how to compare plant growth on soils from different depths and with different fertility levels; the effects of fertilizer on plant growth are compared; how raindrops wash the soil is seen; how plants draw water from the soil is discovered; an acidity pH indicator is used to test various soil samples; rocks are labeled and collected; finally, students test the capacity of the soil samples they have collected to hold water.

PLANT GROWTH FACTORS UNIT: Classroom projects cover the effect of air, light, and temperature on germination; conditions that inhibit germination are tested; diseases are researched; insects are studied; finally students learn how seeds are certified for pedigree and performance.

PLANT CHARACTERISTICS UNIT: The students learn to set up projects that demonstrate a wide variety of plant characteristics, including showing how plants give off oxygen and how they make food from air, water, and nutrients from the soil in the presence of sunlight; a study of how plants pump fluids from their roots to the food factory in their leaves is undertaken; comparisons are made between carbohydrate and oil seeds; transpiration rates of plants are compared; growth regulators are experimented with.

GROWING AND USING PLANTS UNIT: The students study how plants are used for food, feed, and fiber and in industry. They will learn to: start a tree from seed; grow a plant from a pineapple; transplant a tree or shrub; learn the way to prune fruit trees; grow a houseplant; undertake their own project and grow a crop of either field, lawn, vegetable, flower, or tree. They will set up charts that give nutritional information about various fruits and vegetables and then consider how to plan a balanced diet.

The following 4-H manuals will prove useful for further projects.

4-H Vegetable Garden Project Manual. 4-H, Ag.13, revised March 1976. This excellent manual includes a complete planting guide for the various sections of California for various vegetables.

4-H Weed Project Manual, UC Ag: 155. The objective of this manual is to set up a two-part project to study weeds and their impact upon farming. The students collect, identify, and mount weed plant specimens, and then learn ways to control weeds in their gardens, lawns, or farms.

California 4-H Entomology Project, Ag. 82. Work sheets 1-13 composed of detailed diagrams of insect body parts, which are extensively labeled. A sheet of labels for an extensive collection is included.

For further information on gardening with children, use Chevron Chemical Company's A Child's Garden: A Guide for Parents and Teachers. San Francisco, California, 1974.

Delcye Bailey

PESTICIDES

To spray or not to spray. . .that is the question! Companies manufacturing and selling pesticides recommend preventive as well as maintenance treatment, so some farmers start spraying early and never stop. Each year they have to use more spray to get the same effect.

On the other hand, some farmers hold off applying any pesticides until it is obvious that a problem exists and then use restraint, applying only enough to control the pests.

When gardening on a small scale, some people attempt to control pests without any chemical means. They use companion plants that discourage certain pests, use harmless insects that prey on the harmful pests, and even go snail-hunting with a flashlight at night.

But with thousands of acres to protect, most farmers are forced to resort to tested and approved chemicals, which are spread by machines rolling through the fields or applied by airplanes flying low over the fields.

The dangers of pesticide pollution are becoming better known as we see humans, fish, wildlife, soil, and water becoming contaminated. Various federal and state agencies attempt to regulate and control the use of chemicals. Research is going on constantly; experiments are even being conducted in insect sterilization. However, the war continues as insects become resistant to chemicals used against them, and new weapons must be created.

Control of pests that damage or destroy crops will continue to be a problem: only through concerned study will we determine the most effective, but least damaging, methods to use.

Maxine Burnworth

INSECTS TO LOOK FOR

Worms
Larvae and pupae
Ants, beetles, bugs, flies, crickets, thrips, centipedes and millipedes, harvestmen, spiders and microscopic animals. How is each important to the farmer?

ALTERNATIVE FORMS OF ENERGY

This section identifies some issues and activities related to alternative forms of energy in agriculture. On many of our field trips this topic was discussed. Although very few concerns had actually implemented such methods, all were interested and were awaiting the time when alternative forms of energy might become more economically sound.

FISHER NURSERY: A GLANCE AT SOLAR ENERGY

Use of natural gas for heating was cut in half by PG&E because of rationing of natural gas imposed by the State Energy Commission. Solar heating was not economically possible at the time. There are efficient solar heating methods in use at this time, but they are still relatively expensive. Mr. Fisher was forced to put in a boiler system and use fuel oil.

SALMANN'S SOLAR HOME

The solar home was designed by Ms. Salmann and built for her by a professional contractor.

1. The floor was made up of five layers: a layer of sand on the bottom, next gravel, then styrofoarm, then cement, and finally black slate (black because of its greater ability to absorb heat).
2. The glass in the home was double-layered and mounted in 6-inch wooden window frames.
3. The walls and ceiling were well insulated (the ceiling had approximately 9 inches of insulation).
4. Solar collectors were mounted facing south.
5. A storage area filled with small rocks (the size of walnuts), for storing warm and/or cooled air, was within the home. A forced-air ventilation system brought the air from the storage area through vents into the home. In addition to the solar system, there was a complete electric backup system with the latest heating/cooling equipment.

(See Sunset, November 1976.)

DAIRY FARM AND EGG FARM

There was limited discussion of recycling wastes for energy production (biomass conversion).

Michael Tucker

SOLAR COOKER

Class made a model oven.

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ALTERNATIVE FORMS OF ENERGY IN AGRICULTURE

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1) Fuels from Plants Bioconversion
2) Fuels from Wastes, Bioconversion
3) Wind Power
7) Solar Heating and Cooling
17) Alternative Energy Sources: Environmental Impacts
19) Alternative Energy Sources: A Bibliography

Gross, Phyllis and Railton, Esther P., Teaching Science in an Outdoor Environment, "Solar Still," pp. 156-158.

Lindsay, Duncan, and Croxton, Malcolm, Solar Energy, Australian Science Education Project, 1974.
Activity 5: "Light Energy and Chemical Change," p. 23.
Activity 7: "The Glasshouse Effect," pp. 26-27.
Activity 11: "Constructing an Energy Absorber," p. 81.
Activity 12: "Using the Energy Absorber," p. 82.

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U.S. Department of Energy, Office of Public Affairs, Washington, D.C. 1 (1) "Fuels from Biomass," (2) "Solar Energy for Agriculture," and (3) "Solar Energy."

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CURRICULUM SUGGESTIONS FOR CASWELL MEMORIAL
STATE PARK

Premise: These are standard componets of the middle school program that can be taught more effectively in a rural setting than on the usual school site.

READING AND LANGUAGE ARTS

- Use field guides to look up birds, animals, and plants.
- Read USDA and county bulletins about the economic value and characteristics of local crops and domestic animals.
- Develop vocabulary of names of natural and cultivated plants.
- Study Latin and Greek roots of scientific names.
- Develop language facility (use of adjectives, adverbs and participles) to accurately describe experiences and observations.
- Dramatize history of area and natural events (for example, pretend to be early settlers or act out the effects of wind passing).
- Keep diaries.
- Write letters to relatives and friends, to hosts on field trips, and to agencies to get information.
- Tell stories; narrate events in sequence.
- Learn to spell new vocabulary.
- Write poetry and first-person stories from viewpoint of someone or something else.
- Listen to farmers, soil conservation director, and other resource people and organize information gathered this way.
- Play Twenty Questions about farming.
- Read charts, seasonal planting tables, density studies, drought records, yield analyses, and so forth.
- Read and listen critically to persuasive material; judge reliability.
- Make generalizations and inferences about agricultural and consumer problems.
- Appreciate great outdoor writers: Muir, Leopold.
- Compare news media reporting with eyewitness understanding.

MUSIC

- Sing outdoor songs.
- Learn rural ballads.
- Play an autoharp, guitar, harmonica, jew's harp, tonette.
- Write parodies and create new music.
- Make and play a reed flute.
- Set original poems to music.
- Make a rhythm band: use leaves, sticks, shells, grass, stones for percussion, strings.
- Key sounds in nature with a pitch pipe.
- Make and use a willow or elderberry whistle.
- Folk dance.
- Note music themes for patterns in nature: wind, water, plant movement, bird calls, animal movement.
- Do interpretive dances.
- Understand how nature inspired composers; listen to music inspired by rural experiences of great artists.

SOCIAL STUDIES

- Learn history of California's agriculture:
  - kinds of crops grown
  - farm economics
  - methods of improving soil
  - need for sources of agricultural water
  - knowledge of farm animals and crops and their requirements
- Analyze soil in various places.
- Find the water table.
- Study maps (plan hikes related to home town).
- Pick blackberries and make jam.
- Harvest and use other seasonal crops.
- Write with blackberry ink.
- Identify insects; find out ecological and economic significance.
- Learn about plant diseases.
- Study effects of poor water management on crops (flooding, drought, inadequate drainage).
- Learn about farm machinery—types, costs, uses.
- Interview farmers about job descriptions, training, working hours, vacations, values, family responsibilities, and so on.

ART

- Make a color wheel using examples from nature.
- Compare arrangement, pattern, design, repetition in nature.
- Make texture rubbings of bark, rock, and so on.
- Sketch with campfire charcoal.
- Mold native clay.
- Make crafts using natural materials.
- Make leaf prints.
- Construct mobiles with bits of things found on the ground.
- Weave cattails.
- Make a tule mat.
- Study the rhythms of fish, ripples, birds.
- Watch light and shadow changes.
- Make clay casts.
- Try sand painting.
- Tie-dye with native plants.
- Make jewelry from seeds, twigs, galls, and so on.
- Make wind chime or wind harp.
- Draw and paint wildflowers.
- Use oak gall ink.
- Sketch leaves, insects.
- Frame interesting compositions, large and minute.
- Make a mural showing types of agriculture surrounding the park or the history of the land development.
- Make ozalid or silk screen prints.
- Mix paints from clays and berries.
- Photograph a sequence.
- Arrange common weeds.

MATHEMATICS

- Make a sun dial (shadow stick).
- Tell temperature, fahrenheit and centigrade.
- Measure humidity, wind speed, evaporation, maybe even rain.
- Earn and save money for the cost of the trip.
- Budget grocery expenses.
- Define problem to be solved.(For example, how many quarts of juice from a batch of blackberries?)
- Use more than one way to solve a problem.
- Tally cricket chirps (one way of estimating temperature).
- Find examples of Fibonacci number series, proportion (for example, sunflower spirals).
- Study concentrations of insect populations.
- Sample and estimate numbers (for example, blackbirds on an acre).
- Pace off 1 acre.
- Graph number of samples in a plot study.
- Use plumb line and level to measure slope.
- Estimate number of board feet,cords of wood in a tree.
- Find height of the valley oaks by several methods.
- Measure diameter and circumference of the trees.
- Relate age of trees to events in Tracy history.
- Follow a compass course.
- Learn about land surveys, sections, quadrants, and so forth.
- Determine weight and volume of wet and dry clay and sand.
- Use ratio and proportion.
- Measure distance across a pond or brook by using equivalent triangles, ratio, and proportion.
- With stop watches measure speed of sound across a field.
- Conceptualize units of measure: tons, feet per second (flow), kilowatt-hours.
- Lay out scale models of skies, fields, and so on.
- Play Kalah (an ancient mathematics game).
- Lay out a treasure hunt by paces, degrees.
- Use statistics and probability; graph measurements.
- Find perimeters and volumes of irregular shapes: water in pond, distance around a marsh.
- Understand economics of conservation: cost of pest control by various methods, taxable income of developed land.
- Use percentages, graphs to show findings.
- Use probabilities in predicting weather, changes.

SCIENCE

- Learn inquiry questioning techniques: What made that hole?
- Use problem solving methods: How can we find out about growing strawberries?
- Sort and classify collections.
- Find examples of relationships between the sun and life.
- Follow a nature trail. Make one for classmates.
- Learn geology in the field.
- Overcome fears of harmless snakes, tame animals, the dark.
- Collect samples for close examination.
- Study succession in an untilled area.

SCIENCE (Continued)

- Determine soil particle size by shaking soil with water and observing sedimentation.
- Observe sources of air pollution.
- Observe composting.
- Find out how farm machinery (pistons, pulleys, and other equipment) works.
- Show examples of the relationship between water and life.
- View the stars at night; learn about the orbits of planets; get ideas of relative positions, distances in light years.
- Examine area the size of a quarter.
- Predict changes that would follow flood, dry spell, summer heat.
- Discover which plants and animals are native, which are imported.
- Find cycles in nature: food, nitrogen, water, and so forth.
- Observe how plants are adapted for places where they grow.
- Make a solar still.
- Find the water table at several places; relate it to life at that place.
- Stop soil erosion.
- Study clouds.
- Make and use a water microscope.
- Wade in a shallow drainage ditch. Find a variety of plants and animals; see how they are adapted; notice litter; measure water flow; describe quality; do simple water quality tests.
- Study owl pellet or fox or raccoon scat. What has been eaten?
- Follow tracks; cast them in plaster.
- Catch a lizard with a grass noose.
- Determine soil porosity.
- Observe effects of fertilizers on plant growth.
- Observe effects of pests on plant productivity.
- Observe an anthill, a beehive.
- Observe effects of wind on vegetation.
- Observe different examples of symbiosis.
- Identify trees, plants, animals, insects.
- Visit a variety of biotic communities: shade, sun, raparian sites.
- Apply the scientific method to agriculture and social problems.
- Determine and compare relative humidites of different biotic communities.
- Study a soil profile; compare it with profiles of other soils.
- Test acidity, mineral content of soil.

HEALTH AND PHYSICAL EDUCATION

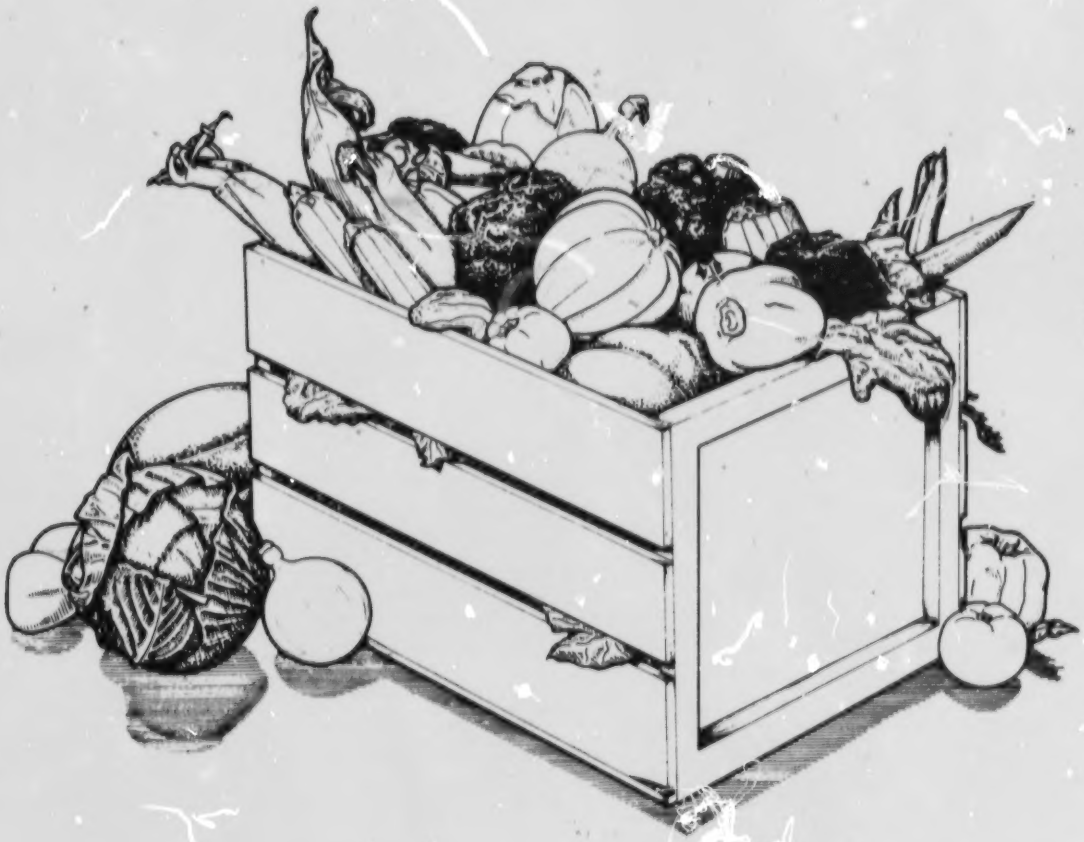
- Dress suitably for sun, wind, evenings.
- Release pressures of schedules.
- Appreciate contrast of rural and urban environments.
- Reflect quietly.
- Learn survival techniques.
- Develop nutritious food habits.
- Understand need for regular sleep pattern.
- Observe examples of how in the struggle for survival, healthy organisms survive.
- Recognize harmful plants and animals: mosquitos, poison oak.
- Clean up litter; discuss how litter makes you feel.
- Share good experiences.
- Learn safety and first aid practices; stay with the group.

HEALTH AND PHYSICAL EDUCATION (Continued)

- Know what diseases are transmitted by certain animals.
- Investigate causes and controls of pollution.
- Develop openmindedness.
- Measure breath and heart rates after exercise, after rest.
- Observe and follow the rules.
- Accept responsibility.
- Swim only in designated area and only when a lifeguard is on duty.
- Swing on a grapevine.
- Throw, walk, play hide and seek, jog.
- Play capture the flag, stalk the deer, and other games requiring natural cover and space.
- Folk dance.
- Follow a natural obstacle course.
- Fish, if conditions permit.

Esther Railton

FOOD PREPARATION



FOOD PREPARATION

The basic goal of the food preparation section is to give students the experience of preparing food from its raw state or unprocessed state.

Please note: The ideal experience would be for students to grow the plants and animals that are used in the food preparation process. The next best alternative would be to buy food from the various farmers that are visited. Another possibility would be to arrange for the students to harvest food from the various farms.

RECIPES

a. Barbecued Chicken (One chicken for every five people.)

Materials: 4 to 5 3-1/2 lb. chickens
Procedure: Cut up each chicken into 10 pieces. Then place each piece on camp stoves. Turn frequently to prevent chicken from burning.

b. Basting Sauce for Chicken
After cutting up chicken
Mix: 1-1/2 cups oil
1/2 cup lemon juice
1/2 cup minced oregano
Baste chicken pieces while they cook.

c. Cole Slaw

Materials: 2 heads cabbage
Mix in bowl: 1/2 pint sour cream
1/4 cup cider vinegar
1/4 cup sugar
1/2 tablespoon salt
1/8 cup celery seed
Procedure: Shred cabbage finely. Mix rest of ingredients in a bowl. Pour over cabbage and toss.

d. Corn Bread
Sift together: 5 cups flour
1 tablespoon soda
1 tablespoon baking powder
1/2 cup sugar
1 tablespoon salt
Add: 4 cups cornmeal
Combine in another bowl and beat well: 5 cups buttermilk
10 eggs
1 cup oil
Stir liquid into dry ingredients with as few strokes as possible. Pour into greased pans (5 x 8 x 10 inch pans) and bake in hot oven for 30 minutes. Please note: When cooking in the out-of-doors, Dutch ovens will work fine.

e. No-Bake Cookies

Ingredients and Procedure: Boil: 1/8 cup cocoa
1 cup sugar
1/4 cup milk
1/4 cup margarine
For 2 minutes

(Please note: Boil over double boiler if possible. It takes awhile for the mixture to reach a boil; stir constantly.)

Add: 1/4 cup peanut butter
1 cup instant oatmeal

Drop cookies from a teaspoon to tray.

f. Noodle Meal (Japanese)

Materials: Noodles (3 packages)
1 large head of cabbage
Sliced beef (2 lbs.)
2 cups oil
A dash of pepper and salt
1 bottle of soy sauce

Procedure: Brown meat in skillet; boil noodles in separate pan.
Drain water from noodles and combine meat and noodles and other ingredients.

g. Chinese Chicken Salad

Ingredients: 3 lbs. of bean sprouts
1 whole chicken
2 cucumbers
1 small jar of sesame paste
2 tablespoons of soysauce and sugar

Procedure: Boil the bean sprouts and chicken
Drain soup from chicken and bean sprouts
Shred the chicken meat and marinate in soysauce and sugar
Slice cucumbers into long strips
Marinate the chicken, bean sprouts and cucumbers in sesame sauce
If possible, refrigerate this dish for several hours, as it is a cold dish.

h. Pepper Beef(12-14 persons) Chinese

Ingredients: 8 large bell peppers
2 lbs. of beef
1 small jar of brown bean sauce
5 tablespoons of soy sauce
2 tablespoons of corn starch
1/2 cup of oil

Procedure: Cut beef into 1 inch by 1/8 inch strips and marinate it with brown bean sauce, sugar and soy sauce.
Fry beef and peppers separately.
Use the remains of sauce for the paste and pour over the dish.

i. Burrito Beef Filling

Ingredients: 3 small onions chopped (Triple recipe)
1 lb. hamburger
1 can tomatoes
2 teaspoons chili powder
2 teaspoons salt

Procedure: Brown onions and hamburger in a skillet for a few minutes, stirring with a fork to break meat into bits. Add remaining ingredients and simmer for 45 minutes.

j. Mexican Tortillas (Both corn and wheat)

Ingredients: 2 cups masa harina (wheat flour also)
1-1/3 cups warm water

Procedure: Combine above ingredients to make thick paste. Pinch off chunks and press flat in circles. Cook on moderately hot, dry griddle, turning frequently until dry and lightly flecked with brown spots.

k. Mexican Wedding Cakes

Ingredients: 1 cup butter
4 teaspoons sugar
2 cups flour
2 teaspoons vanilla
2 cups finely chopped pecans

Procedure: Cream butter and sugar, add flour, nuts and vanilla. Make small balls and place on cookie sheets. Bake at 300^{0} for 30 minutes to 45 minutes. Remove from cookie sheets and roll in powdered sugar (or shake a few at a time in a sack of powdered sugar.) When they are cool, roll or shake again in powdered sugar. (Recipe makes 100 wedding cakes.)

l. Jicama Salad

Ingredients: 1 large Jicama
2 medium red onions
1 large green pepper
4 stalks celery
4 tablespoons Italian salad dressing

Procedure: Cube all together. Place in large bowl. Add Italian salad dressing to taste. Marinate for 1 hour or so. Enjoy with Mexican, Spanish cooking.

m. Beef Kabobs

Ingredients: 5 lbs. chuck roast,cut into 1-1/2 inch cubes, removing bones and excess fat.

Beer Marinade:
- 1-1/2 cups beer
- 1 teaspoon dry mustard
- 1 teaspoon ginger
- 1/8 teaspoon tabasco sauce
- 2 teaspoons sugar
- 4 teaspoons marmalade
- 2 minced cloves of garlic
- 1 teaspoon of vinegar
- 1/4 teaspoon of dry oregano
- 1 bay leaf
- 1/2 teaspoon salt
- 3 teaspoons soy sauce

Procedure: Combine the meat and the marinade in an airtight jar and store in refrigerator for 24 hours. Prepare the following for assembly in 1 inch chunks: Mushrooms, onions, pineapple, cherry tomatoes, bell pepper, zucchini, and whatever else you choose. Using skewers or straightened coat hangers thread meat and other ingredients. Cook for 20 minutes over hot coals.

n. French Fried Onion Rings

Ingredients:
- 2 large onions
- 1 cup water
- 1 teaspoon salt
- 1/4 teaspoon pepper
- 2 beaten eggs
- 1 cup milk
- 1-1½ cups All-purpose flour
- 1 teaspoon melted butter
- 3/4 cup flat beer

Procedure: Skin and cut crosswise into 1/4 inch slices
2 onions
Combine milk and water
Soak onions in this for 1/2 hour. Drain and spread on absorbent paper and dredge with fritter batter. Put in a bowl and mix well flour, salt, pepper, butter, and 2 beaten eggs. Add beer gradually, stirring constantly. Fry in preheated oil until light brown. Drain on absorbent paper.

o. Potato Salad

Ingredients: 5 pounds of potatoes
2 onions
2 tablespoons mustard
1/3 cup vinegar
1 dozen hard-boiled eggs
1 head of celery
2 or 3 green peppers
Salt and pepper to taste
1/2 jar mayonnaise

Procedure: The above ingredients are diced and combined with ingredients for seasoning.

p. Vanilla Ice Cream

Ingredients: 4 eggs
2 inches vanilla bean, cut very finely about this long _____
1-1/2 cups sugar
1 quart half and half
5 cups milk

Procedure: Mix eggs very well in ice cream container. Add sugar and half and half. Stir well. Add milk and vanilla bean. Put ice cream maker together. Put about 3 inches crushed ice, then handful of rock salt, then ice, then salt, etc. Crank until it becomes very hard to turn. Add more ice and let sit until time to serve.

q. Sassafras (rootbeer)

Ingredients and Procedure: For today's batch: To rootbeer starter add 1-1/2 gallons water. Let this mixture sit until ready to use. Add ice to cool.
For next batch: Prepare rootbeer starter. Mix 1 teaspoon yeast with 1 cup warm water. Let sit 5 minutes in sun.
Meanwhile mix 1 3-ounce bottle of rootbeer extract with 5 cups sugar. Add 1 gallon lukewarm water to yeast mixture and mix well. Allow to sit uncovered to allow yeast to bubble.

r. Johnny Cake

Ingredients: 5 cups corn meal
2 cups sugar
1 tablespoon salt
3 cups boiling water

Procedure: Mix corn meal, salt, and sugar. Stir in water until mixture is smooth (batter will be very thick). Drop by tablespoons into well-greased griddle. Fry for 6 minutes. Turn and fry 5 minutes. (The batter can be thinned with up to 1/2 cup milk or water.)

s. Favorite Pancakes (10-4 inch pancakes)

Ingredients: 2 cups flour
1 egg
1 cup buttermilk
2 tablespoons shortening or oil
1 tablespoon sugar
1/2 teaspoon soda
1 teaspoon baking powder
1/2 teaspoon salt

Procedure: Beat egg; add remaining ingredients. Slowly beat until smooth. Grease heated griddle if necessary. To test griddle, sprinkle with a few drops of water. If bubbles skitter around heat is just right. Pour batter from tip of large spoon or pitcher onto hot griddle. Turn pancakes as soon as they are puffed and full of bubbles but before bubbles break. Bake other side 'til golden brown. Enjoy.

t. Scrambled Eggs and Vegetables

Ingredients: 2 eggs per person
2 tomatoes
1 bell pepper
1 zucchini
1/2 red onion

Procedure: Saute cut up vegetables in skillet. Drain off excess liquid after vegetables are tender. Put in eggs and stir to keep from burning. Take off just as eggs are drying.

u. Butter Making

Ingredients and Procedure: Crank butter churn with whipping cream in it until it becomes very hard to turn and cream has "separated." Pour off curd (milky substance). Rinse butter with cold water. Pat into small dish and "design-stamp" on it. Place in shallow stream or refrigerate to keep cool. (Please note: Butter can be made each day.

Note: The ethnic groups that have had an influence on farming in California can be represented in the menus. The pioneer theme works in very well. Foods prepared by the Spanish, Portuguese, Italian, Japanese, and Chinese are appropriate for this experience.

FIELD TRIPS

Any one of the field trips would fit into the food preparation section of this experience (See Field Trip section of Guide).

Toris Jaeger

HISTORY OF FARMING

"Let us never forget that the cultivation of the earth is the most important labor of man. Unstable is the future of the country which has lost its taste for agriculture. If there is one lesson of history that is unmistakeable, it is that national strength lies very near the soil."

Daniel Webster

PIONEER FARMING

RECREATION
- Songs
- Poems
- Homemaking and Other Related Crafts

FOLKLORE

TYPES OF FARMS (See Field trip section of guide)

SUGGESTIONS FOR FURTHER STUDY
- Farm Life
- Farm Culture

PIONEER FARMING

The pioneers were the third major cultural influence that took root in California. Their migration followed the Indians and the "Californios," or Mexican/Spanish influence. The pioneers migrated to the West during the gold rush years, between 1846 and 1880. They were primarily Anglo-Saxon and brought with them their own social customs, foods, tools, and life-styles. Many or all of the household items were made by members of the family. Clothes, candles, broom, furniture, and even the house itself were all made from materials surrounding the pioneer.

The pioneer farms were run almost entirely by the family. The family worked on the farm the majority of the year, planting, sowing, and harvesting the crops. The children worked during the late spring, summer, and fall months when the crops needed to be sown and harvested. They would attend school only during the winter months when the crops required little attention and they could be "spared" from chores.

The important crops were corn, wheat, dairy products, and livestock. Oftentimes the larger farms would be able to diversify into two or three crops. However, most of the pioneers were rather limited in financial resources as well as available land.

With the advent of mechanization, the life of the farmer was drastically changed. What had once been done by hand by members of the family now became mechanized and produced more efficiently by machine. Today, corn is still one of the most important products; wheat, soy beans, alfalfa, and livestock are the other mainstays of the farm community.

Some of the issues for further study might be a discussion of how mechanization had helped or hindered the farmer. Research might be conducted on actual farms and they might be compared to the pioneer farms of the past. A discussion of what crops have lost their importance to the farming community and the reasons for the loss may be pursued. Finally, a research project might be attempted to learn what the farmer did with his crops once they were harvested--how he processed them and how he actually marketed or sold them.

Related activities have been already discussed in the craft and cooking sections. Please refer to those sections.

SUGGESTED FIELD TRIPS

McGinnis Farm (see Field Trip section of guide and Additional Field Trip section of guide).

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Toris Jaeger

RECREATION

The following section contains a variety of games, crafts, songs, poems, and activity suggestions that could be used as a recreation/leisure component to a curriculum on farming. Most of these activities could be utilized to develop skills in the various disciplines such as language arts, music, physical education, math, science, and social studies.

GAMES

Blindman's buff
Hide and go seek
Tug-of-war
Build a tree house
Races--potato sack race and 3-legged race
Watermelon-eating contest
Pie-eating contest

MUSIC AND DANCE

Make your own musical instruments such as tambourines,drums, kazoo, willow whistle, spoons, sticks, etc. Find someone in your community that can play an old-fashioned instrument, such as the spoons or jew's harp. Have the person demonstrate and teach the class if possible. Find out how he or she learned to play.

Folk dancing and square dancing are both popular activites in rural areas and can be used in social studies.

Farming songs, pioneer songs and foreign songs are contained in the music section.

STORY-TELLING, POETRY, AND DRAMATIZATION

Story-telling, the reading of poetry, and the acting out of stories, poems, or folktales are exciting recreation activities. A number of folktale resources are listed in the Folklore section, and farm stories and folktales are listed in the Recreation bibliography,page 43.

CANOEING

Caswell Memorial State Park is located on the Stanislaus River, and canoeing was a popular activity during our week's stay. A number of animals were observed, including great blue heron, muskrat, kingfisher, and raccoon. We also observed a number of water-pumping systems used by the local farmers for irrigation. The river is also an excellent place to do freshwater study.

Carol Place

HOMEMAKING AND OTHER RELATED CRAFTS

The basic goal of the crafts activities is to give the students a knowledge and first-hand experience of the process involved in making things for the home. The various activities give excellent examples of the recycling of household materials into new and usable items. Also, there is an appealing simplicity to the items made in these crafts and a joy of direct participation with the product.

CANDLE MAKING

Materials: 1 ball strong string for candle wicks
candle wax (used or in blocks)
4 coffee cans
1 stove or Coleman Burner and fluid

Procedure: Make candle wicks by braiding three 12-inch strings together. Melt candle wax in coffee cans. Have 2 cans filled with cold water. Dip wick in wax and then in cold water until candle is about the size of a quarter in diameter.

QUILTING (Pillow slips or quilts)

Materials: Material scraps both small and large
Patterns
2 sets of sewing needles
Box of straight pins
Box of drawing pens or pencils

Procedure: Patterns can be made from poster board, paper, cardboard. The patterns are cut into three different sizes: one 10-1/2 inch pattern; for backing of pillow slip, one 4-1/2 inch pattern for tracing on material, and one 3-1/2 inch pattern for tracing inside of 4-1/2 inch pattern for sewing line. Sew nine 4-1/2 inch pieces together along 3-1/2 inch lines on wrong side of material. Then sew nine sewn pieces to 10-1/2 inch piece of material. Foam, old nylons, etc. can be used for stuffing, or an actual pillow can be placed inside of slip. The slip is then sewn together. For quilting, the same basic procedure can be used. A quilt with farming scenes would be appropriate as a follow-up activity.

CORN HUSK DOLLS

Materials: 2 packages of corn husks (can be purchased from grocery store or Mexican restaurant).
1-inch styrofoam balls (purchase one per person).
Pipe cleaners (one per person--white preferred)
1 ball of string
material and leather scraps
package of straight pins
felt tip pens of various colors
4 or 5 pairs of scissors

CORN HUSK DOLLS (Continued)

Procedure: Soak corn husks at least a few hours before using. Cover styrofoam ball with corn husk and twist at either end like candy wrap. Tie at each end. Wrap pipe cleaner at each end by placing pipe cleaner on folded end of husk. Husk is gathered around pipe cleaner at one end. Pipe cleaner is turned toward person. The other end of corn husk is folded 1/2 inch and the fold is gathered around other end of pipe cleaner and tied. A narrow piece of corn husk is folded the long way and then made into a small package, which is then tucked into the front fold of a head part of doll.

The arms (pipe cleaners with husks) are tucked up under back fold. The arms and head parts of doll are tied tightly under package that makes the bustline. Six nice, full husks are chosen for the skirt. Three are laid down with narrow end away from person. The body of the doll is laid face down with the head toward person. Three more husks are laid on top of doll with narrow ends away from person. All husks are gathered at the waist and tied. The skirt is then turned over and straightened out. The skirt can be tied with a string loosely until dry, for better form. The skirt can also be trimmed with scissors at the bottom to make it even. The doll can be decorated with material or leather scraps. Felt tip pens can be used to make faces on the dolls. Yarn or corn silk can be used for hair. When making a boy doll, the skirt is cut up the middle and tied at the feet. Have fun!

OTHER APPROPRIATE CRAFTS

Soap making
Leather work
Tin work
Back-pack-looms or loom building
Gardening
Brick making
Cabin making
Apple-head dolls
Whittling
Wool carding, weaving, and sewing
Seed sprouting
Fireplace building
Butter making (see Recipes)
Flute making and making of other musical instruments
Flower making
Puppet making (see Folklore)
Candy making

The crafts would work nicely as follow-up activites after any one of the field trips covered in this guide. Perhaps the McGinnis Farm would be the most timely example of some of the homemaking crafts.

SOURCE

Complete directions for most of these crafts can be found in Rancho Days and Pioneer Days, both curriculum guides by Warren Arnold of Orinda, California.

Toris Jaeger

TIE-DYE

Materials: materials for scarves, white socks, T-shirts, theater curtain, and puppet clothes. Items from nature depending on the colors you wish, rubber bands, string, small pebbles, coffee cans or pots, sticks to stir with and remove hot, wet material. Salt or vinegar to set colors.

Natural dye materials:
Black: elderberry bark
Blue: blackberries
Violet: red cabbage
Green: lupine purple flowers, mustard leaves and flowers, plantain, rubarb, spinach, staghorn lichen
Red-violet: beets, dandelion roots
Orange: cherry bark, marigolds, mountain ash berries
Yellow, tan, or yellow-brown: elderberry leaves, goldenrod, lupine marigolds, mistletoe, wild mustard, mullein, nettles, onion skins, staghorn lichen, turmeric (a spice), willow bark
Pink: grapes, cranberries
Purple: blueberries
Red: alder, bark of the roots, red onion skins, raspberries, strawberries

Procedure: Boil dye materials to bring out the color. Dip material to be dyed into clear water. Wring out as dry as possible. Tie cloth with little or big "tufts" or"poufs"in several places. Rubber bands are easier to use than string, but be sure you make them tight. Start with lightest color and dip one or more poufs. Rinse well in cold water if you want a patch to stay a light color; cover it with plastic baggie while dipping the other colors. Rinse after each dip. When dyeing is finished, remove rubber bands, and dry.

TRACK CASTS

Materials: Plaster of paris, water, can to mix it in, stirring stick, paperclips, strips of tagboard, talcum powder (optional).

Procedure: Locate clear animal track (usually near edge of pond or stream, in mud). Make a ring with a tagboard strip, fastening it with a paper clip, allowing a border around the print. Press it gently into the earth. Sprinkle with powder to keep soil particles from sticking to the plaster. To make a hanger for the cast, open a paper clip, bend it, and set it into the plaster while still wet. Mix plaster, adding plaster to the water until thick but pourable. Add salt to speed up setting, or vinegar to slow it. Let cast set 3 hours or overnight. Dry

TRACK CASTS (Continued)

more before removing the soil. To Recast: grease the cast well with petroleum jelly, set into a shoebox of sand, use new cardboard ring for form, pour plaster into mold. When hardened, knock the two casts apart. Smooth and trim with knife or sandpaper. To make cast hard, boil for a few minutes in a solution of 1 tablespoon borax to one pint of water. It can be painted with tempera, oil point, or acrylic paint.

FOLKLORE

Johnny Appleseed said, "I pray for the day. . .one day. . .just one day . . .when men of all races and beasts of all types will gather in a huge circle beneath this apple tree and sing and talk and breathe peace together." (Ed Graczyk, Appleseed: A Play of Peace, Anchorage Press, 1971, p. 37 and p. 51.)

Folklore helps children discover their interests, concepts, and values. "The tales are environmental in nature since they stress, in one way or another, people's relationships to their physical surroundings." (Allan Kownslar, Investigating the Environment: Folktales Two, Houston, Texas: Harris County Department of Education, 1976 , p. 5.)

The use of folktales involves cognitive and affective goals. Cognitive goals include the use of data, skill development, and concept formation to stimulate some kind of response from each student. Affective goals are attained when students' interest is aroused or when they empathize with the effects of environmental change on people.

OBJECTIVES

1. Have students become familiar with John Chapman, known as a voice in the wilderness.
2. Teach John's ideas about man and his surroundings.
3. Make students aware that living things are interdependent.
4. Have students make puppets and demonstrate an understanding of the folklore of John Chapman.

ACTIVITY

1. Have students listen to the story Johnny Appleseed, written and illustrated by Aliki.
2. Have students discuss what Johnny did; what he loved; what he wished; and what was going on when he lived.
3. Divide students into small groups and have each group demonstrate the story using their puppets.

MATERIALS

1. Paper bag
2. Newspaper
3. Wooden stick or dowel
4. String
5. Colored paper and scissors
6. Paints or crayons
7. Paste or tape

DIRECTIONS

1. Fill the bag with small pieces of torn or shredded newspaper.
2. The dowel or stick should be inserted in the open end of the bag and until it touches the bottom of the bag. Gather the open end of the bag around the stick, and tie the string tightly to form a neck. Make sure the stick extends far enough out of the bag to make a handle.
3. The features of the face can be added with paint, crayons, or pieces of colored paper.

Note: Faces or animals can be cut from paper and mounted on sticks to make simple puppets.

SOURCE

Wankolman, Wigg, and Wigg, A Handbook of Arts and Crafts, 1969, p. 87.

Keiko Kochi

I AM THE FARMER

"I am the provider for all mankind. Upon me every human being depends. A world is built upon my toil. Because of my industry, America leads the world; her great commerce is the work of my hands. My reaper brings food for today: my plows hold promises for tomorrow. In war I am absolute; in peace I am indispensable. I am the hope of the race, the balance wheel of civilization. When I prosper, men are happy; when I fail, all the world suffers. I live with nature, I walk in green fields under the golden sunlight, and I try to do my humble part to carry out the great plan of God. Even the birds are my companions; they greet me with a symphony at the new day's dawn and chum with me until the evening prayer is said. If it were not for me, the treasures of the earth would remain securely locked; the granaries would be useless frames; man himself would be doomed to extinction or decay."

Author unknown

SOURCE: Submitted by Kathryn Nelson, "Alice in Dairyland," Wisconsin Department of Agriculture.

THE OLD WOMAN AND HER PIG

An old woman found a sixpence. She said, "What shall I do with this sixpence? I will buy a pig." So she bought a pig. On the way home they came to a stile. The old woman said, "Pig, pig, jump over the stile."

The pig said, "I will not jump over the stile."

The old woman went on till she met a dog. She said, "Dog, dog, bite pig! Pig will not jump over the stile, and I shall not get home tonight."

The dog said, "No, I will not bite pig."

The old woman went on till she met a stick. She said, "Stick, stick, beat dog! Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The stick said, "No, I will not beat dog."

The old woman went on till she met a fire. She said, "Fire, fire, burn stick! Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The fire said, "No, I will not burn stick."

The old woman went on till she met some water. She said, "Water, water, quench fire! Fire will not burn stick. Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The water said, "No, I will not quench fire."

The old woman went on till she met an ox. She said, "Ox, ox, drink water! Water will not quench fire. Fire will not burn stick. Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The ox said, "No, I will not drink water."

The old woman went on till she met a butcher. She said, "Butcher, butcher, kill ox. Ox will not drink water. Water will not quench fire. Fire will not burn stick. Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The butcher said, "No, I will not kill ox."

The old woman went on till she met a rope. She said, "Rope, rope, hang butcher! Butcher will not kill ox. Ox will not drink water. Water will not quench fire. Fire will not burn stick. Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

THE OLD WOMAN AND HER PIG (Continued)

The rope said, "No, I will not hang butcher."

The old woman went on till she met a rat. She said, "Rat, rat, gnaw rope! Rope will not hang butcher. Butcher will not kill ox. Ox will not drink water. Water will not quench fire. Fire will not burn stick. Stick will not beat dog. Dog will not bite pig. Pig will not jump over the stile, and I shall not get home tonight."

The rat said, "Get some cheese. Then I will gnaw the rope."

The old woman got some cheese. She gave it to the rat. Then the rat began to gnaw the rope. The rope began to hang the butcher. The butcher began to kill the ox. The ox began to drink the water. The water began to quench the fire. The fire began to burn stick. The stick began to beat the dog. The dog began to bite the pig. The pig jumped over the stile, and the old woman got home that night.

ACTIVITIES

1. Read the entire story to the whole class and ask the students the following questions:
   a. How much did the old woman pay for the pig?
   b. What did the old woman ask the pig to do? The dog? The stick? The fire? The water? The ox? The butcher and the rope to do?
   c. At the end of the story who helped the old woman? How?
2. Have the students draw pictures to describe the whole story.
3. Role playing would be fun for the children.

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Keiko Kochi

MUSIC

These songs were found in A Treasury of American Folklore, edited by B.A. Botkin (New York: Crown, 1944.) The following are the footnotes concerning the source of each of the songs.

"Young Man Who Wouldn't Hoe Corn"was from Resettlement Song Sheets: Number 3 of a Series of American Songs Rarely Found in Popular Collections, edited by Charles Seeger.

"Seven-Cent Cotton and Forty-Cent Meat" was noted to be "as sung by the Almanac Singers, transcribed by the Almanac Singers."

"The Farmer Comes To Town" was also from Resettlement Song Sheets: Number 1 in a Series of American Songs Rarely Found in Popular Collections, edited by Charles Seeger.

QUESTIONS FOR DISCUSSION

1. "Young Man Who Wouldn't Hoe Corn"
   - Why is it important to hoe corn?
   - Can you think of another word for hoeing?
   - What did the author mean by "she gave him the mitten"?

2. "Seven-Cent Cotton and Forty-Cent Meat"
   - What kind of farmer is singing the song?
   - Why is he so poor this year?
   - When do you think this song was written?
   - How much money does the farmer lose when he buys back pork from the store?
   - Why does the pork cost so much more in the store?
   - Who was the Roosevelt in the song, and how did he help the farmer?

3. "The Farmer Comes To Town"
   - Who is the middleman referred to in this song?
   - Why does the farmer live on credit 'til the fall?
   - What would happen if the farmer in the song realized that he was the man who feeds them all?
   - What could he do about his situation?

Maxine Burnworth

NUNG JAR LOR — Chinese folk song

Background information: Most Chinese farmers know this popular folk song. The song depicts the contentment and happiness of the farmers after their harvest is over. For more than two thousand years agriculture was the chief form of economy in China. Eighty percent of the Chinese population prior to this modern age were farmers. Farming is usually very intensive since China does not possess extremely extensive arable land for plantation farming. In many provinces in the past the farmers were mostly tenant farmers and their lives were miserable, especially when the landowners were mean and greedy. However, the Chinese farmers on the whole were contented about their fate. Singing played an important role in lightening up the farmers' spirits even at the time of crop failure.

ACTIVITIES

1. Have the students sing this song in rounds to discover the harmony of the song.
2. Role playing can facilitate and enrich the students' understanding of the different ways of life of a tenant farmer, a rich landowner, a free-landowner, a pawnbroker and the government tax collectors.
3. Have the students write essays depicting the various aspects of farm life.

NUNG JAR LOR(THE JOY OF THE CHINESE FARMERS)

Nung jar lor, zoo sze marn chiu door, (the joy of being a farmer is during the harvest when the crops are abundant,)
Mai liao chang sze, dar liao woor, (after selling the silk threads and harvesting the crops,)
Darn barn yuen lee shiao hor hor. (I'll sit in my great bamboo patio and laugh merrily,)
Nun jar lor, nung jar lor, nug jar lor, nung jar lor,
(the joy of being a farmer is abundant,)
Chang kwai lor. (I am really happy.)

Melody:

Prepared by: Wun-ping Ma

NOTE: Each country has folksongs that deal with agriculture, the base of each society. Any farm unit should include the rural folk music and folklore of the cultures represented in the local history.

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HISTORY OF THE AREA UNDER STUDY

HISTORY OF SAN JOAQUIN COUNTY

LAND USE GAME

HISTORY OF SAN JOAQUIN COUNTY

San Joaquin County is now the fourth richest agricultural county in the U.S. At one time, however, a large part of the area was a tule-choked inland sea. The errant waters of the San Joaquin, the Stanislaus, the Calaveras, the Mokelumne, and the Sacramento rivers supported a wealth of plant and animal life. The vegetation included tules, willow, wild grapes, buckeyes, sycamores, cottonwoods, poplars, soaproot, lupine, bunch grass, wild roses, blackberry, walnut, alder, white and live oak, and poppies. Wildlife included herds of elk, antelope, and deer. Trappers reported having spotted fifteen grizzly bear at one time. Beaver were abundant, as were raccoons and river otters. The water fowl, which in days gone by darkened the skies while migrating, included shouting cormorants, cranes, herons, swans, ducks, and geese. Within the last century most of this area has been changed by man. One place where much of the native plant life can be seen and where animal life is preserved is Caswell State Park.

The Indians were the first to occupy this area. In 1830 an estimated 25,000 lived in the Central Valley, about half of them on the 1,000 square miles of the Delta. They lived off the land and in relative peace with each other. By 1833, however, an estimated 20,000 had died in the Central Valley because of an epidemic of malaria, which sickened all the tribes and every village. The survivors could not bury all of the dead because of their vast numbers. Bodies were decaying everywhere. Fire was used as a means of disposal at first, but that method was abandoned as the number of survivors dwindled. In 1852 the census for the Indians of San Joaquin County was 374. The figure in 1860 was 40. In 1870 only 5 remained.

The Spanish explored the edges of the county but, finding it unsuitable for cattle, chose to settle along the coast, where the weather was more pleasant and the grazing better for the cattle. The Spanish were interested in the Indians' souls, however. In fact, their most extensive activities in the area dealt with the capture of Estanislao (Stanislaus), a Christianized Miwok Indian who returned to the area from Mission San Jose in 1829. Estanislao was the chief conspirator among the Indians of the Delta area who resisted the Spanish. He also held a high position of respect among the Indians who had not yet been "saved." Many Spanish soldiers and thousands of rounds of ammunition were made available for his capture. He was taken alive and returned to Mission San Jose. Even though Estanislao led a group of Indians in an area in which the Spanish had little interest, they would not allow his subversive attitude to undermine their efforts to save the "heathens."

The first northern European to explore the area was Jedediah Smith. He came in search of beaver. Soon the area had attracted the attention of the Hudson Bay Company. The French-Canadian trappers, who were employed by the company, never formed an attachment to the land. They did congregate annually in a locale now known as French Camp for reunion and festivities.

The gold rush had a strong effect upon the area. The Sacramento River became the main artery through the area to the mines. Stockton's location on the river became significant. Inland navigation became important overnight.

The gold attracted the Chinese, who began coming to the area in 1852. The Chinese at first were miners or servants. Soon they began small businesses, and later they became farmers. By 1910,1,873 Chinese people were in the area. The Chinese were especially important in the area because of their contribution to the reclamation of the land by the labor that they provided for the construction of the levees.

On their way to the gold fields, people made note of the potential of this area for farming. Both the peat and mineral soils attracted their attention. Before farming could begin, however, it was clear that flood control was necessary. Levees were constructed, and the battle to reclaim the land began. The first profitable crop, which was wheat, was raised in 1877. At that time the estimated cost for reclaiming the land was $10 an acre. The estimated cost for reclaiming Union Island was half a million dollars. Beyond the cost of the land and the cost of reclamation, additional expenses were necessary before the land could be rendered fit for farming.

The Portuguese have a long and unsung history in California. In 1542 Joao Rodrigues Cabriho (Cabrillo) began exploring parts of southern California. In the nineteenth century the Portuguese were mainly involved with gold mining and homesteading. From about the 1870s on, dairy farming became the major activity of the Portuguese immigrant.

The ethnic backgrounds of San Joaquin County's residents are varied. Other groups are the Filipinos and the Italians.

SOURCES

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Anna McGuire

WESTERN LAND USE ROLE PLAY

Use the following readings (on the next two pages) for a role-playing exercise about the use of land in the American west.

Divide the class into groups of four. Each group member is to be an Indian, miner, rancher, or farmer. Distribute role descriptions to the proper persons (each student reads ONLY his own role description). Explain the following situation:

> Each of you wants to use or claim a nice piece of land right where certain foothills of the Rocky Mountains level out into the plains. This land has a river running through it that attracts buffalo to drink. The soil is rich and supports a heavy cover of wild grass. Something like gold has been seen glimmering among the river rocks.

After groups have had a chance to meet together and discuss their positions, have one group come to the front of the class. Each member should explain why he should have the land. Go around twice, to allow for rebuttals. The second time around, each speaker may call on classmates for arguments to back him up.

Next, have each group list ways in which the dispute might be settled. Remind students of the problems of no nearby governments or law enforcers in the west. Possible means of resolving the conflict might be:

1. Vote for the best arguments.
2. Decide by straw vote.
3. All be convinced by one of the claimants.
4. Appeal to the territorial governor.
5. Try to reach a compromise.
5. Appeal to a deity.

Discuss the advantages and disadvantages of methods the students suggest. Which is most popular? Which is most practical? Why is it hard to decide which person has a fairer claim?

Ask different groups to act out several methods of reaching a resolution, then talk again about which methods seem to be best.

SOURCE

"Conflict 4-6 Guide Reference: Studying American History (pp. 25-29).

Anna McGuire

THE INDIAN

The Indians were the first people on the land. They had begun coming to America from Asia perhaps 20,000 years ago. You have already read about some eastern Indians—the Cherokees. As land became scarce in the East, the Indians living there were pushed farther and farther west. The United States government got the Indians to move west by making land treaties with them. These treaties gave the Indians money in exchange for their land. But usually these Indians didn't want to move. They went west because they were forced to go. The western land given to them was not like the good farmland they had lived on in the East. And they often came under attack by the Plains Indians who were already living in the West.

These tribes were mainly nomads. That is, they had no fixed home. They wandered from place to place—following the huge herds. These Indians believed that they had rights to the land. But these were rights to use the land—and to live off it. To "own" land had no meaning for them. They did not believe that a person could fence off a piece of land for himself. They did not believe he could buy it or sell it.

THE CATTLEMAN

The Great Plains was cowboy country. Much of this area was "open range." It was unclaimed land belonging to the government. Since nobody but the government owned it, there were no fences in the way. A cattleman could graze his herds free of charge. In 1865, roughly 5,000,000 cattle roamed the Texas ranges. Then the railroad pushed across the West. Thus began the "cattle kingdom." Beef earned high prices in the eastern United States. And the Texas rancher now had a way to ship his cattle to these markets. To reach the railroads, he marched huge herds on "long drives" north. The key figure in the cattle kingdom, of course, was the cowboy. On his fast horse, he controlled the herd. He roped and put the owner's brand on every steer. And with his six-shooter, he kept away cattle thieves and Indians. Ranchers and cowboys were like the Indian in one way. They wanted the land kept open for grazing. They didn't like fences.

THE FARMER

The farmer was the frontiersman who came west to truly "own" and farm a piece of land. He was the one who finally settled the Great Plains. The farmer came west by mule, by covered wagon, by railroad. Mainly he was drawn by the offer of cheap land. He got it from both the federal government and the railroads. Soon homestead farms dotted the open range. And around them sprang up fences. These, the farmer felt, were needed to protect his land from the cattleman's herds. There were no trees for wood fences. But the Plainsman used newly-invented barbed wire. He claimed all rights to his land. He wanted to be able to fence it, farm it, sell it—or even give it away.

THE MINER

Gold! Its discovery at John Sutter's mill near Sacramento, California, in 1848 began a gold rush. Within a year, 80,000 men had roared into California. These "Forty-Niners" were wild for gold. They aimed to get rich quick. From the 1860's through the 1880's many such strikes were made. Gold and silver were found in Colorado, Nevada, Montana, the Dakotas. Mining camps sprang up. Some turned almost overnight into "boom towns."

Men looked for gold in stream beds. This was the easier way. Others dug tunnels into the mountains. This way was harder and it also cost lots of money. High-priced tools were needed. So this kind of mining often was taken over by large companies. Every miner worked on his claim—or piece of land. He claimed mainly the right to take gold or silver from this land. He cared little about what grew on it.

FIELD TRIPS AND SPEAKERS

FISHER NURSERY

MCGINNIS FAMILY FARM

BROCCHINI'S CROP FARM

DELTA MENDOTA CANAL

JOHN MASS—VEALE TRACT FARMS

KIRBY MCCLELLAN—SOIL CONSERVATION SERVICE

SALLMANN'S SOLAR HOUSE

BALOOCCI'S WALNUT ORCHARD

WEDRON SILICA PLANT: TOM HOLMES—CONTRA COSTA CONSERVATION DISTRICT

SPRECKELS SUGAR REFINERY

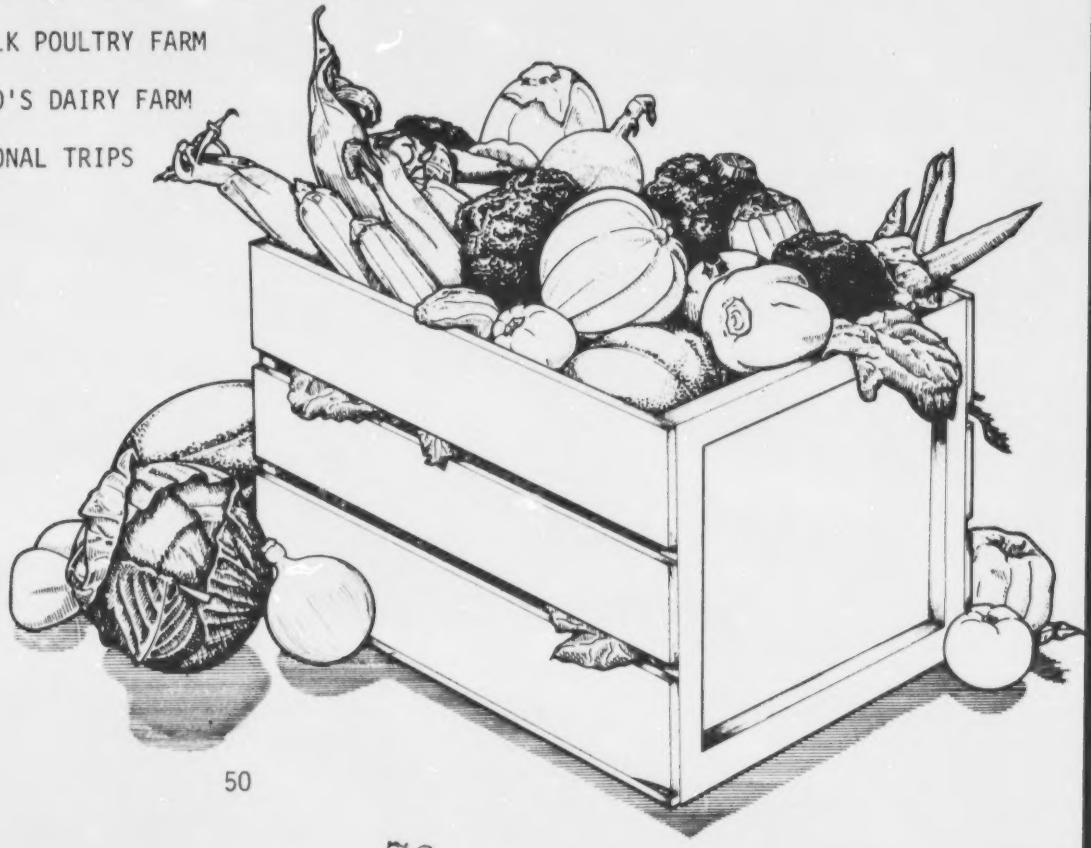
C&B FARM EQUIPMENT

DR. STEPHEN WILHELM—PLANT PATHOLOGIST

DEN DULK POULTRY FARM

MACHADO'S DAIRY FARM

ADDITIONAL TRIPS



FISHER NURSERY

The Fisher Nursery on Austin Road south of Manteca is an excellent example of a large commercial producer and wholesale supplier of ornamental house plants. They wholesale to outlets in the Bay Area such as Navlets, discount centers, such as K-Mart, and supermarkets such as Safeway. The markup range is from 40% to 400%.

Our tour of their large greenhouses consisted of an informal talk and question and answer session as we walked along between the long rows upon rows of various plants. Their stock ranged from a wide variety of cactus, ivy, ferns, and succulents to weeping fig. We observed a wide variety of seed bed flats, and we were told only one transplanting was made to the pots they would be sold in, thus eliminating undue labor costs.

A stable set of environmental conditions was maintained by a very modern steam heating and ventilating and cooling system. The watering system consisted of both sprinklers and a drip system for the hanging baskets. Fertilizing was done by mixing liquid fertilizers into the water supply and dispensing it during watering.

Cuttings taken from the plants during their growth to shape them and stimulate fullness, we were told, were composted. We observed that the large dump container in the greenhouse we saw had many cuttings that could be used for starters in a classroom project or garden.

FOLLOW-UP ACTIVITIES

1. Plan a plant propagating project. Use direct seeding methods if you have land available on the school grounds; or begin by first trying seeding in flats,transplanting to larger flats, and finally transplanting the seedlings to jiffy-pots for a plant sale.

2. Have large window boxes made where you can direct seed and then transplant to an outdoor bed.

3. Make a terrarium from any variety of jars or jugs.

4. Plant a variety of cuttings gotten either at a large nursery or from house plants and yard plants at home. Learn how to make cuttings, how to use plant mix, which watering methods to use, how to transplant the cuttings at the right time, and where to get all needed materials.

SOURCES

Activities 1 and 2 are described in 4H Club, Plant Propagation Project, Unit I, University of California, Agricultural Service, March 1970 (2d rev.).

Activity 3 is described in 4H Club, Exploring the World of Plants and Soils, exercise III-E-5.

Activity 4 is described in 4H Club,Plant Propagation Project, Unit II, Cuttings, University of California, Agricultural Service.

Delcye Bailey

MCGINNIS FAMILY FARM

The McGinnis family owns a 20-acre farm including goats, sheep, ducks, geese, chickens, pigeons, two horses, a rabbit, an alfalfa field, a vegetable garden, and some fruit trees. The McGinnis family just started growing kiwi. The family uses biological control for their fruit trees and vegetables instead of chemical spray, and does organic farming. But none of this farm could be considered a supporting aspect of the McGinnis livelihood.

Mrs. McGinnis takes care of the farm mainly by herself. Her job is not easy at all. Her chickens and ducks seem to be laying all over, and it is difficult to collect fresh eggs. Mrs. McGinnis feeds animals and milks goats. She gets 2 gallons of milk a day. According to Mrs. McGinnis, goats are easier to deal with than cows. Mrs. McGinnis commits herself to her farm life. Sometimes she feels lonely and isolated because of her commitment.

The barns are very interesting to see. Outside the barns, ducks and geese are busy moving around. In one of the barns a barn owl stays still during the day. The owl eats gophers and mice.

The McGinnis farm is a good choice for introducing children to farming ideas, animals and nature.

CONCEPTS

1. Living things are dependent on one another and their environment.
2. Man has been a factor affecting plant and animal succession and environmental processes.

FARM ACTIVITY

1. Students see animals and milk goats.
2. Students get an idea of the size of 20 acres and discover what is living there.
3. Students write down their impressions and sketch animals and plants.

QUESTIONS

What kinds of animals did you see?
Why are they on the farm? Why are there ducks on the farm?
Did you see a barn owl? What does it do there?
Are the two dogs and the cat good friends?
Did you taste some fruits of the farm? How was the taste?
What does Mrs. McGinnis do with goat milk?
What do you think about Mrs. McGinnis' job?
Have you thought about how everything is harmonized on the farm?

FOLLOW-UP ACTIVITY

1. Students make puppets about what they saw on the farm.
2. Students choose a partner and make a story from their own farm experience.
3. Students share their puppet story by demonstrating before other students.

MATERIALS

1. Paper bag, the size to be determined by the size of the hand.
2. Construction paper.
3. Rubber cement, or paste, stapler, tape.

DIRECTIONS

1. Put hand in the paper bag with the index finger touching the top.

2. Spread the thumb and the second finger and make a small hole in the side of the bag where fingers touch.

3. Features that have been cut out can be stapled or glued in place.

Note: Students can use their own sketches when they make puppet figures.

SOURCE

Wankelman, Wigg, and Wigg, A Handbook of Arts and Crafts, 1969, p. 85.

Keiko Kochi

BROCCHINI'S CROP FARM

The following information was obtained on a field trip to Brocchini's farm, approximately 1 mile north of Caswell State Park. Mr. Brocchini operates a diversified farm of approximately 2,500 acres. He raises tomatoes, onions, almonds, alflafa, black-eyed peas, peppers, grapes, and sugar beets. His farm offers an excellent example of present-day farming practices and problems.

The information is organized under areas of inquiry, and it is suggested that the teacher assign small groups of the class to each major heading. The subheadings offer possible questions that the students might ask the farmer or research themselves. The information under the subheadings was obtained during our class tour of the Brocchini farm and is listed to give the teacher an idea as to what kind of information might be obtained by the students. This information could also be used to develop meaningful activities for the students under each of the subheadings (for example, soils). I have suggested several activities that could be performed by the students.

AREAS OF INQUIRY

I. Machinery
   - A. Cost and financing
     1. Tomato picker, $150,000; electronic sorter, $50,000
     2. Tractor, $30,000; plow, $10,000 to $15,000
     3. Bank loan, usually of 5-year duration
   - B. Maintenance and cost of operation
     1. Does most of his own maintenance (at $15,000 to overhaul tomato picker).
     2. Farmer saves old pieces of equipment for later use.
     3. Diesel fuel: farmer uses 900 to 1,000 gallons per week.
     4. Two to three hours daily are spent on maintenance
   - C. Causes for use of more machinery and the effects of this greater use on farm labor
     1. Loss of immigrant farm laborers and increased wages for farm laborers forced farmers to use more sophisticated equipment.
     2. Use of 12 to 20 people and automatic tomato picker replaced 60 + farm laborers.
     3. Three harvesters owned, which run day and night for 6 to 8 weeks during tomato harvest; equipment stands idle the rest of the year.

II. Crops
   - A. Crops grown
     1. Tomatoes
     2. Onions
     3. Alfalfa
     4. Almonds
     5. Peppers
     6. Black-eyed peas

II. Crops (Continued)
    7. Grapes
    8. Sugar beets
B. What are the advantages of the diversification of crops?
    1. Failure of one crop or low market value offset by a different crop.
    2. Some crops are used to replenish the soil.
C. Why rotate crops?
    1. Alfalfa and other legumes replenish soil nitrogen.
    2. Helps to prevent disease buildup for certain crops.
D. What factors affect crop prices, and how does this affect the farmer?
    1. Bargaining of grower associations with cannery to establish a minimum price.
    2. Buyer generally determines price.
E. How are different crops harvested? What machinery and labor is needed?
    1. Grapes: picked by hand.
    2. Tomatoes: picked by machine.
    3. Almonds: use of shaker, blower, and sweeper.
    4. Alfalfa: mower and bailer hired out.
F. What insects affect different crops?
    1. Alfalfa: aphids
    2. Tomatoes: horn worm and caterpillars that feed on young tomatoes
    3. Almonds: caterpillar of night flying moth that feeds under the skin of the almond and overwinters in almonds left hanging on the tree.

III. Use of chemicals and pesticides
A. What chemicals and pesticides are used and why?
    1. Herbicides are sprayed early to prevent weed growth.
    2. Insecticides are used when pests reach a critical level.
B. What determines the use of fertilizer and spray pesticides?
    1. Predator/prey count taken by independent consultants or chemical companies
C. Who regulates the use and disposal of chemicals in agriculture and what factors tend to control overuse or misuse?
    1. U.S. Department of Agruculture classify chemicals.
    Class 1 chemicals require a permit: reason for use must be shown before permit is given; distribution and use are controlled.
    Class 2 chemicals are similar to Class 1: cans must be rinsed three times and then disposed of in a certified dumping area.
D. What alternative methods of pest control are being used?
    1. Spray only when the pest-to-beneficial-insect ratio favors the pests.
    2. Experimental use of parasitic wasps.
E. How are various crop pests controlled?
    1. Herbicides are used on weeds early in the season; later, cultivation is used.
    2. Most insects are controlled by sprays.
    3. Worms on almond trees are controlled by removing all hanging almonds late in the fall.

IV. Labor
  A. How much do farm laborers make?
    1. Twenty people hired year round make between $4-$5 per hour and get help with rent.
    2. Migrant workers who work approximately 5 months earn $3-$4 per hour.
  B. How much does the farm owner make and what expenses does he have?
    1. Brocchini makes approximately $2,000,000 yearly.
    2. Taxes and payments on equipment, etc., take all but $70,000, which is used to upgrade this farm.
  C. What agencies help protect the laborer from unsafe and unfair farm practices?

V. Water
  A. Where does the farmer get his water?
    1. River
    2. Canals
    3. Wells
  B. How is water flow and quality regulated?
    1. Water flow is regulated by the district.
  C. How does water quality affect crop production?
    1. High amounts of dissolved salts can destroy crops.
  D. What factors determine water quality for the farmer?
    1. Amount of dissolved salts in the water
  E. How are levees made?
    1. See activity on making a dam.
  F. What methods of irrigation are used?
    1. Overhead sprinklers on almonds and grapes.
    2. Other crops are flood-irrigated by the use of siphon pipes.

VI. Soil
  A. What are soil types?
    1. Adobe clay
    2. Sandy loam is an approximately equal mixture of sand, silt, and clay.
  B. What affect does soil type have on the type of crops that can be grown?
  C. Does soil type affect the type of equipment and farming practices used?
    1. Machinery bogs down in heavy clay soils, such a adobe; therefore special techniques are required to farm it.

Collect soil samples both in a well-cultivated field and in undisturbed areas, such as under brush in the state park.

For more activities, see part 1 of this guide.

Charles Mayer

DELTA MENDOTA CANAL: TRACY PUMPING PLANT

The Tracy Pumping Plant is run by the Federal Bureau of Reclamation to deliver irrigation water to 29 irrigation districts serving over 3 million acres, primarily in the southern San Joaquin Valley. The electricity to run the pumps and other systems is generated at Shasta Dam and other power plants in the Central Valley Project (CVP) of the Bureau of Reclamation. The CVP was initially authorized by President Roosevelt in 1935.

Water from Shasta, Folsom, and Friant dams, among others, is controlled to provide electricity and a supply of water at the various intake points of canals throughout the CVP. When this water is needed by the canals, releases are made at the reservoir into the natural rivers, and the flow goes to the canal intake for pumping. Additionally, water and electricity from the CVP are used for domestic and municipal supplies.

At the same time the CVP is removing large amounts of water from the Sacramento-San Joaquin River Delta, the neighboring California Department of Water Resources California Aqueduct (CA) facility is removing 1.5 million gallons of water a day. This water is being pumped to the southern San Joaquin Valley, south of the range of the CVP and then over the mountains to the Los Angeles basin.

The quality of this irrigation water must be good enough not to cause damage to crops. The most common problem of water quality is total dissolved salts (TDS). The salt problem is natural during periods of low flow because of salinity from the ocean being carried in at high tide. Other causes of TDS are agricultural tail waters carrying pesticides and fertilizers washed off of the field. In 1976-77, many farmers were forced to drill their own irrigation wells for quality irrigation water.

In an attempt to protect fish life, the CVP and CA have installed louvered fish screens. These screens divert fish from the mainstream of the pump flow into fish-taking facilities. These screens work very poorly on juvenile-sized fish. The fish that are saved are hauled by tank truck to other locations away from the pumps and released into the Delta.

The fish-taking facility is an exciting place to take field trips. Few other areas allow students to observe so many species of fish at various stages of development. Additionally, the fish-taking facility is on the old San Joaquin River and allows the students to compare the natural channel and habitat along a real river with the rock-lined or cement banks of the Delta Mendota Canal.

ACTIVITIES

1. Construct a relief map in class of where your water supply comes from.
2. Compute how much water is pumped by the pumping plant each day.

ACTIVITIES (Continued)

3. Research water and dam construction agencies and current issues. Have a panel discussion with different members of the class representing the various points of view (i.e., farmer, conservationist, water agency, etc.).
4. Identify as many fish types as possible. Determine which are migrants and which are local Delta fish. Which numbers are higher? Is this a seasonal run?

Ed Simons

JOHN MASS—VEALE TRACT FARMS

On Veale Tract, low-grade agricultural land is being improved by the addition of compost and gypsum (calcium carbonate). This is a unique operation in that the compost is waste paper and wood chips from the fibreboard pulp mill in Antioch, California. The gypsum is from the waste wallboard of a wallboard production plant in Antioch. The calcium carbonate of the gypsum helps to "loosen" the heavy loam soils and clays.

Additionally, John Mass has participated in a sewage sludge project with East Bay Municipal Utility District and the United States Environmental Protection Agency (EPA). The EPA is monitoring the deposits for heavy metal residues for the 5 years following the addition of the sludge. This soil has also been treated with compost from fibreboard and gypsum waste. After the alfalfa was damaged by floods in the winter of 1978, the alfalfa was cultivated under and corn was planted. The corn crop was growing well at the time of the field trip.

Mass discussed the economics of farming and the power farmers could have if they were organized. Proposition 13 was discussed. In this case Proposition 13 allowed more profitable farming in an area where urban encroachment and increasing taxes are constant threats to quality farm lands, let alone poorer grade farm lands.

This 1,000-acre farm is family-owned, and most labor is provided by family members, relatives on salary, and juvenile labor.

Mass discussed a federal project on the Colorado River where calcium carbonate as an end product of manufacturing, may become available to farmers at reduced costs.

Tom Holmes of the Contra Costa County Soil Conservation District discussed the soil water levels and flooding problems of Veale Tract. Veale Tract is similar to one of the Delta islands, where the water is pumped over the levee from the Delta for irrigation. The excess irrigation water and the existing groundwater are then drained off and returned to the Delta through a system of drainage ditches. These ditches are usually 6-8 feet deep and keep the groundwater from rising high enough to affect the roots of the crop plants.

Veale Tract is not only being developed into better farm land, but is also being used as a pheasant hunting club. Also some fishermen and pleasure boaters use the levees of the island.

ACTIVITIES

After this field trip, obtain some heavy loam or clay soil, mulch, and gypsum. Have students plant seeds in mixtures of soil, mulch, and gypsum to compare growth of the plants with and without soil additives.

Edward A. Simons

KIRBY MCCLELLAN—SOIL CONSERVATION SERVICE

The Soil Conservation Service is a relatively new agency that deals with agricultural people and units of government. It began as a result of the 1930 Dust Bowl, and it began in the Department of Agriculture. It is a small and diversified agency. It has 13,000 personnel nationwide. The state and national associations of districts are lobbying bodies.

The Resource Conservation District is a local group providing technical services. It is a subdivision of the state government and it has an elected board of directors. Any landowner can become a member on the condition that he should have strong interest in conservation. Gradually, the Soil Conservation Service got into water, wildlife, solid waste, land use planning, resource code, etc.

The Colusa District coordinated range management with the Soil Conservation Service, Bureau of Reclamation, and Forest Service. It is conducting a pilot study on soil erosion effects on water quality.

The Environmental Protection Agency is working to clean up water. Fines can go up to $25,000 per day. It provides national guidelines, and the state water quality control board makes its own programs. The state is working through the Regional Water Quality Control Board. The two most important measures concerning conservation are the following:

1. Section 208, Public Law, the Clean Water Act, refers to Non-Pollutant Contamination. It applies to agriculture, agricultural waste, dairies, fertilizers, pesticides, herbicides, and so forth.

2. The Resource Conservation Act of 1977, which directs public meetings in each county throughout the nation every 5 years to determine conservation issues. The secretary reports to Congress; develops programs for proper management; and operates a land inventory and monitoring program, which measures erosion at computer-selected sites. (The local district chose sheet and rill erosion, gully, streambanks, roadways, and construction sites.)

The Soil Conservation Society of America is a professional society.

McClellan strongly emphasized the need for conservation education for the state. "By developing the school conservation education programs, and by working through the soil conservation district," he said, "you are in the soil conservation packet." Any school that is interested in soil conservation programs can be provided land and plants to carry out the programs.

The Soil Conservation Service has recently developed small watershed programs. It is developing flood control, for example, in Bear Creek, Mosche Creek, and Potter Creek. Wells are tested (for example in the Patterson Drainage Project) to find out the channel texture and effect of floods.

The Resource Conservation District develops projects and makes soil surveys every 50 years. Examples are river basin planning for the San Joaquin and Sacramento rivers.

Large watershed planning and long-range flood spectrum planning are also developed.

Wun-ping Ma

SALLMAN'S GOAT FARM

Elizabeth Sallmann's goat farm is a one-woman operation and is representative of an efficient and smoothly run family farm. Ms. Sallmann is a native of Switzerland, where she also raised goats before moving to this country. Her goat herd consists of approximately 50 milking does of the Saanen breed, which are noted for their high production of milk (with low butterfat content) and their gentle nature. She also had 4 bucks for breeding and about 25 kids at the time of our visit.

Ms. Sallmann's primary source of income is through the sale of her goat's milk. She is not licensed to sell fresh goat's milk, and the market for this is somewhat limited. Her female kids will be used to supplement her milking herd and the male kids will be sold locally or auctioned.

Ms. Sallmann milks once a day, using automatic milkers. She milks about 12 goats at a time in the milking parlor, which consists of two raised platforms with herringbone-style milking stalls and automatic feeders. Her goats produce milk 305 days a year, with an average of 2,200 pounds of milk per doe.

At the end of our tour we were served ice-cold goat's milk, which was delicious and very difficult to distinguish from cow's milk.

ACTIVITIES

1. A pre-trip activity would be to study the anatomy of a goat, including milk production, ruminent characteristics, and teeth. Compare these with other animals.
2. Draw a diagram or display of the various steps involved in milk production.
3. Compute the quantity of milk produced each day at the goat farm. How much feed is required to produce this quantity of milk? Compare this to the amount of feed required for cows, and the corresponding milk production.
4. How is goat's milk different from cow's milk? Why is it not as popular in the U.S. as it is in other countries?
5. Make a display on a bulletin board, or reproduce a miniature goat farm or solar house.
6. Visit a powdered dry milk company.

Note: A good book on raising goats is Goat Husbandry, by David MacKenzie, published in London.

Carol Place

SOLAR HOUSE

Elizabeth Sallmann lives in a recently constructed solar home, which we had an opportunity to visit. Two large solar panels were situated on the south side of the house to collect heat from the sun. Inside is a huge compartment, adjacent to the solar panels, containing small, walnut-sized rocks, which are the medium used for heating and/or cooling.

The solar house has an energy-saving backup heating/cooling system utilizing a heat pump, a recent innovation in energy conservation. The floor covering is made of slate and is insulated with sand, gravel, styrofoam, and cement. The windows are all insulated glass, another energy saver. The total square footage is 1,000 square feet.

An added bonus to the slate floor is its utility as a slateboard for chalk drawings. The younger members of our group thoroughly enjoyed this aspect of the solar house. The entire group appreciated Elizabeth Sallmann's warm hospitality and willingness to share her knowledge and time with us.

ACTIVITIES

Refer to section on Alternative Forms of Energy for activity suggestions.

Carol Place

BALDOCCHI'S WALNUT ORCHARD

This farm represents a two-person operation of approximately 120 acres on three parcels (a family farm). Other labor is mostly from other family members. The economics of a one or two-person operation were discussed by the Baldocchis.

All of their trees are budded and/or grafted onto a different root stock for better production. Budding and grafting were actually demonstrated to the group. The major unsolved disease in the walnut industry is "black line," a disease that develops at the graft line and eventually kills the tree. Other pests are controlled by the use of pesticides when necessary.

The relative merits of cultivation of orchards for control of competitive vegetation (weeds), on the one hand, and no cultivation and use of pesticides on the other, were discussed. Root development of trees is damaged with each cultivation.

The group toured the walnut processing shed. Machinery used in harvesting and processing was discussed (sweeper, dryer, sheller), and tasty samples of two varieties of walnuts were enjoyed by all!

The irrigation system used is a rainbird sprinkler system for orchards, which conserves much more water than the flooding system of irrigation. Mr. Baldocchi receives approximately a 20% refund from the U.S. Soil Conservation Service for water savings.

ACTIVITIES

1. Play the Indian shell game using walnut shells.
2. Practice budding and grafting. Discuss these techniques and their use with other types of trees also.
3. Gather, dry, and hull walnuts and almonds.
4. Plant walnuts and watch a tree grow!

Melva Rush

WEDRON SILICA PLANT: TOM HOLMES

CONTRA COSTA CONSERVATION DISTRICT

On our field trip to the silica sand quarry, we met and talked with Tom Holmes. Tom is charged with soil conservation planning in Contra Costa County.

It was interesting that the majority of the sand was shipped to Gallo Wineries for glass products. Tom indicated that six to eight double truck loads a day went to Gallo. The Wedron Corporation was originally located in Monterey County near Pacific Grove, but because of increasing environmental concerns, was forced to relocate.

There was a variety of concepts discussed relating to the beginning and continued operation of the quarry. Those concepts are outlined below for use in pre- and post-field-trip development.

I. Land use
   A. Multiple use activities on the lands
      1. Cattle grazing
      2. Wildlife habitat (waterfowl)
      3. Mining raw materials (silica sand)
      4. Education

II. Water conservation (recycling)
   A. Use of 10,000 gallons of water per day in sand washing
      1. 3000-6000 of these gallons are recycled from holding ponds.

III. Wildlife habitat
   A. Holding ponds create excellent habitat for waterfowl.
      1. Rudy ducks, young grebes, and coots were sighted.

IV. Reclamation (recycling the land)
   A. Quarry pits were being filled with waste materials, and topsoil was replaced as the top layer.
      1. Native grasses were reseeded.
      2. Trees (not necessarily native) were being planted, primarily for aesthetics.

V. Soil types
   A. Basic soil types found in Contra Costa County were pointed out (color-coded map handout).
      1. Land suitable for cultivation (Classes I-IV)
      2. Land not suitable for cultivation (Classes VI-VIII and urban lands)

Michael Tucker

SPRECKELS SUGAR REFINERY

Sugar beet production, from seed to harvest, is highly mechanized. The process of refining the beets into sugar is also mechanized. The by-products of that process are used in interesting ways.

When the beets are brought to the factory they are weighed. There is a"guaranteed market" for the beets, which means that they are purchased at the buyer's price. The sale is assured, however. The beets have an average sugar content of 15%. When a load of beets comes to the factory, tests are conducted to determine the sugar content. The higher the sugar content, the higher the price will be.

The beets are then put into huge piles until the refinery can accommodate them. The steps of sugar production follow. The beets are washed in flumes (to remove dirt). The beets are passed through a slicing machine. When they exit the machine they resemble shoestring potatoes and are called cassettes. The purpose of the shredding is to make the extraction of sugar easier. The cassettes are then transported (upwards, by means of a conveyor belt) and placed in a diffuser. Hot water is added, and raw juice is extracted. A by-product, called pulp, remains. It is rerouted and will be discussed later. The raw juice is placed in a carbonation tank with milk of lime and CO_2 for the purpose of purification. The mixture is filtered, and a dry lime cake is extracted. Impurities are trapped in the cake. Sulphur dioxide is added to further remove impurities. Water is then removed. The product is now referred to as "thick juice." A final purification takes place in a vacuum pan, where the juice is boiled until crystalized. The product is then called massquete. The massquete (a brown substance) is washed off the white sugar crystal by means of water and centrifugal force in an automatic centrifuge. The damp crystals are then tumbled dry in drums at a low heat.

Sugar is often packaged at the refinery. Hundred-pound sacks are filled at the Spreckels site in Manteca.

The lab runs about 1,000 tests a day at all stages of production. These are conducted to make sure that the product meets specifications. Improvements in the processing may be suggested by the chemists in the lab.

Railroads transport much of the sugar to consumers. Trucks may move sugar in bulk. Liquid sugar (a mixture of 2/3 sugar to 1/3 water) is the form in which soft drink and candy manufactuers prefer it. Liquid sugar is transported in tank trucks.

Spreckels seems to be making good use of their by-products. The beet pulp is fed to cattle, which are brought to the site for the purpose of fattening. Lime is reclaimed, and water is recycled.

During the tour, questions were raised about the degree to which brown sugar was refined. Members of the group were under the impression that brown sugar was a less refined sugar. We were informed that brown sugar is actually "Kleenraw," which is the refined white sugar crystal with a molasses coating.

The group also noted that spoiled beets were being processed.

ACTIVITIES

1. Grow sugar crystals.
2. Study and observe machinery.
3. Conduct an experiment to show how sugar rots teeth. (Soak extracted teeth in Coca Cola for several days.)
4. Study, compare, taste various forms of sugar.
5. Investigate the production of other sugars (for example, corn syrup).

Anna McGuire

C & B FARM EQUIPMENT

The tour of Frank Coelho's show room, shop and back lot and his discussion were interesting and informative. The facts learned lend perspective to the other trips and give insight into the problems of labor, taxes, and overhead, which are faced by the farmer and his suppliers.

Mr. Coelho began by describing the inventory of parts he carries. The availability of a particular part can save the farmer from crop losses, which could amount to huge sums of money. Mr. Coelho did complain about the burden this large inventory causes him when the inventory taxes are due.

Next we visited the shop. Here Mr. Coelho went into the costs of repairing the equipment. Much of the highly specialized machinery seems to be very delicate and in frequent need of repair. These repairs are costly! Repairs, when possible, are done in the field. This is especially true during harvest, when time is of the essence.

In the back lot we were informed of the costs of the equipment. A tomato harvester, when equipped with electronic equipment, costs $150,000. The expected life of such equipment is 5 years. Maintenance on such equipment must be carried out every year. The computerized parts of that machine are serviced every year at a cost of about $20,000.00. The $42,000 tractor we saw was equipped with air conditioning, stereophonic sound, and other niceties, which at first seemed excessive. Later, it became clear that these comforts would allow for more efficiency on the part of the operator.

In Mr. Coelho's conference room we learned about many important problems. He explained that the end of the bracero program in the mid-sixties triggered the farmer's dependence on farm equipment. Labor costs, he reports, have been increasingly unreliable since that time. The specialized farm equipment, while in use for only short periods during the year, actually save the farmer much consternation. He knows that, provided the equipment works and the weather is right, he can get the crop in. This is true no matter what the labor situation may be.

Mr. Coelho explained that the increased costs of steels have affected the prices of farm equipment. Other increases, such as fuel and labor costs, have affected the prices also.

Mr. Coelho's background in farming makes him well suited for his line of work. He seems very well informed on the problems of farmers. He seems to know his business inside and out and is willing to share his knowledge.

Although I feel that teachers should have a similar tour, I do not feel that such a tour would be very valuable to students. The presentation may be too abstract and sterile for them. I do recommend studying farm equipment while it is in operation in the field.

Anna McGuire

DR. STEPHEN WILHELM—PLANT PATHOLOGIST

University of California

Dr. Wilhelm discussed the major purposes of agriculture, the two main concerns being production of food for people and animals, and production of fiber for making clothes. He defined the term agroecosystem as meaning the management of the environment for crop production. Because agriculture is so basic, Dr. Wilhelm's belief is that what is best for agriculture is best for everybody.

He then discussed the four pillars on which the modern agroecosystem rests. The first pillar is the quality of management. The State Department of Food and Agriculture in Sacramento develops the agricultural code for the state. This code is law. Every county in the state has an office to enforce the laws and decisions of the department. In every country with a government, you will always find a ministry of agriculture because agriculture is so basic and its management is thus so essential.

The second pillar discussed was the genetic characteristics of crop species. Dr. Wilhelm pointed out that fewer than twenty crops are basic to feeding the world. Six are the cereals: wheat, rice, rye, corn (maize), millet, and sorghum; four are root crops: potato, sweet potato, cassava (manihot or tapioca), and taro; four are legumes: bean, soybean, chick pea, and alfalfa; two are sugar crops: cane and beet; and two are tree crops: coconut and banana. Besides these staples, there are the beverage crops, the vine, the salad and dessert fruit crops, the oil crops, and crops grown for medicines, ornament, and perfumes. Of the fiber crops, cotton is the most important. Horticulturalists are now collecting and preserving all wild relatives of these crops to protect and preserve the genetics of the plants.

Monocrop cultures and machine harvesting have been developed by modern agriculture for the sake of efficiency and high yields. Multiline cultivars (genetically diverse species of a crop) may replace genetically uniform cultivars, however. Genetically uniform corps tend to have a high degree of susceptibility to disease, and thus to economic disaster. However, planting a mixture of twenty or thirty individual lines of wheat, for example, would reduce the possibility of the whole crop being wiped out, because disease reaction would be variable within the crop.

Industrial technology, the third pillar, is important to agriculture not only in the area of the development of machines, but also in the area of the synthesis of fertilizers and pesticides. The chemical synthesis of ammonium (NH_3) has been one of the most important discoveries of our century, according to Dr. Wilhelm. The limiting factor of plant growth worldwide is nitrogen. However, the natural nitrogen cycle is too slow and inadequate—industry needs to synthesize ammonium if people are going to eat.

The fourth pillar is the interaction of crops and pests and disease. Dr. Wilhelm expressed the great need for the use of soil fumigation chemicals if successful cultivation of many types of crops is to occur. He discussed his opinion that the Environmental Protection Agency (EPA) is a major factor to be faced by agriculture today. The EPA now scrutinizes every decision to use a pesticide in this country. Many EPA investigators are attorneys and thus may have little knowledge of the workings of agriculture.

We pay a high price for the EPA, and he feels that a balance of qualified people from different viewpoints would be a more efficient way to run the EPA. As an example, he discussed the fact that the cost of registering a chemical is so high today that very little experimentation with new chemicals is taking place in this country—people go elsewhere, where no such laws exist (Mexico, South America, and so on).

In closing, Dr. Wilhelm discussed the international research agencies associated with each of the twenty major crops of the world, situated in different countries around the world. Much communication and sharing of new discoveries and knowledge in the field of agriculture seems to be occurring on an international level.

For a more detailed explanation, see Stephen Wilhelm, "The Agroecosystem: A Simplified Plant Community," reprint #1328 vi, from Integrated Pest Management (1976).

Melva Rush

DEN DULK POULTRY FARM

The den Dulk ranch is located near Manteca and produces eggs for the Bay Area market. Half a million laying hens produce nearly 450,000 eggs daily. 200,000 hens are on this ranch, and the rest are on other ranches near Oakdale, Merced, and Lockwood. Another half million younger chickens will come into production in the near future. All of the chickens are white, with large red combs. They are several varieties of Leghorn, namely Shavers, Highlines, and Decalb. By the time they reach the den Dulks, they cost $2 apiece and are 18-20 weeks old. They lay about 18 months, molting (losing feathers) once or twice. When the price of eggs drops after Easter, about 75% of the chickens are sold to Campbell Soup Company. While the pens are empty they are disinfected and cleaned. The Merced flock produced 87% at a good time, and dropped to 50% at a bad time. The best production on the Manteca ranch was 90%.

The area under the pens is cleaned out with water under pressure, while the chickens are feeding. This water is recirculated thorugh a series of ponds. Some is used for fertilizer, but only in furrows, not for flooding use. The hens are checked for mites, as any infection cuts down on production. Ten thousand birds are in one "house."

For 17 hours a day there is light in the pens, so the hens are "burned out" at the end of 18 months from forced production. Their beaks are trimmed,with the top portion slightly shorter than the bottom. This allows them to eat and operate the waterer but prevents them from pecking each other. If one should have a spot of blood on it, the others would shortly peck it to death. They are kept four to a small pen, which barely allows them room to move.

Young girls are employed to gather eggs and can gather as many as 90-100 cases in a day. Two of the employees are Rumanians. They have ranches in Rumania and are here to learn more about how egg production is handled in the United States.

Four or five hens in each house die each day. Records are kept and a close watch is held on production figures.

The food the chickens eat has many nutrients. It includes limestone (roughage for their crops, where the food is prepared for digestion), corn, milt, vitamins, "laying formula," and filler feed. The den Dulks have tried recycling manure, but it is too expensive a process. They use garden feed, wheat, and barley.

At U.C. Davis, they are using a manure-powered generator for the production of chicken feed, but it costs $300,000 for the machine.

The double-decker chicken house has two levels of chicken pens, one above the other. This complicates cleaning under the pens and also feeding and gathering eggs but cuts down on the expense of building the house and cost of lights.

In the packing room, eggs are candled (held before a penetrating light in a darkened room to reveal internal characteristics—white, yolk, and air cell). This permits grading, and eggs of poor quality are removed from the conveyor belt. These are the "dirts," "bloodies," "chex" (they have thin spots in their shells), and "leakers"—all usable for dog food and frozen eggs. The chex are sold directly from the ranch at a reduced price to consumers.

One hundred forty cases of eggs are packed in an hour. A case holds 30 dozen. During full production, employees work six days a week, 10 hours a day. This compares with a 30-hour week on maintenance during the slow summer season. A machine weighs the egg and selects which conveyor belt it shall travel down. One route is for Jumbo (30 oz. per dozen), two for Extra Large (27 oz.), two for Large (24 ox.). one each for Medium (21 oz.), Small (18 oz), and Pee-Wee (15 oz.). During the time the pullets (young hens) are laying, the machine changes to three small and two pee-wee channels. The cartons are automatically packed and stacked. The cartons are given "pull" dates and generally reach the markets within a couple of days. At 45° the eggs will remain "fresh" for 3-4 months.

All the eggs are washed and rinsed with warm water containing a sanitizer and dried before packing. Oiling eggs reduces evaporation of moisture and replaces the cuticle lost during washing. A fine film of lightweight mineral oil seals the pores, cuts weight loss, and halts air cell expansion. This process is most often used when the eggs are to be held in cold storage for a long period of time.

Egg gatherers are paid 27¢ for collecting 360 eggs.

The person who feeds the chickens pushes the hopper along the row of pens and measures out the feed into the trough hanging in front. This process is cheaper than mechanized feeding. With mechanical feeders, someone still had to check to see if the feed was getting where it belonged, and often there was trouble with the machines.

ACTIVITIES

1. Map study: On a map of California, locate Manteca, Oakdale, Merced, and Lockwood. Chart the routes the eggs must take to get to the Bay area.

2. Vocabulary: List all the unfamiliar words and look up their meanings. Comb, molt, furrow, mites, crop, candling, chex, leaker, and pullet are a few to start with.

3. Egg consumption varies from country to country. Which country has the highest consumption? (China, then U.S.) Make a graph showing the countries that use the most eggs and the quantity consumed, on an average. Why did the consumption of eggs from 1951 to 1966 show a drop from 392 to 314?

4. Compare weights of eggs and their classifications by making a chart.

5. Science: Examine a dead chicken. Locate the channel down which eggs travel. Why are there yolks with no whites or shells in the beginning of this passage? What will happen to them? How can you account for some eggs having thin shells and others having hard shells?

6. Assemble the skeleton of a chicken.

7. Cooking: Compile a recipe folder of the favorite recipes from the class using at least two eggs.

8. Language: What is a "cackleberry"? "Hen fruit?" What does it mean to "get up with the chickens?" "Go to bed with the chickens?" What other expressions can you find relating to chickens or eggs?

9. Compare fresh eggs with some that are a couple of weeks old. Is there a difference in smell? How do the yolks compare? The whites? After they're cooked, could you tell which is which? Will it make any difference when you use them in baking? In a casserole? In an eggnog?

10. Compare the "lifestyle" of a chicken living as one of 200,000 on an egg producing ranch with that of a member of a small flock living on a family farm.

11. Trace the steps (on a bulletin board display) that an egg takes from the chicken to the table.

12. Compute approximately how many eggs are produced at the poultry farm in a day, week, month, year. How many people are supplied with eggs from that poultry farm?

13. What is the nutritional value of an egg?

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Maxine Burnworth

MACHADO'S DAIRY FARM

BREEDING

Ed Machado owns a herd of 610 milking cows. At the present, about 460 of the stock are being milked. The prevalent breed of cows is Holstein. He has a few Jerseys among his cows but is breeding them out because of their low milk production. Jerseys usually produce 4 gallons of milk per day to the Holsteins' 6 gallons per day. The cows are bred by artificial insemination. The cows give birth once a year, usually in the late winter and spring months. The young bulls are kept only 1 to 2 days; they are sold for veal or to someone who wants to raise them for beef. The young heifers are kept and raised for new additions to the milking herd. They are allowed to nurse on their mothers for a day or so; they are then fed by bottle until they are weaned. The actual calving takes place in the corral where the cows live. (We actually witnessed the birth of a bull calf. Another cow was in the process of having a calf.) Ed Machado is usually aware of when a particular cow is ready to give birth; he gives assistance when necessary. In emergencies, a vet is called in, 10-15% of the calves born are lost at birth and another 10-15% are lost during the raising process. Ed Machado intends to build a calving barn to compensate for the losses. The expense of this venture is $450 per cow.

MILKING PROCEDURE

One track of cows is milked at one time. Five men handle the milking, which involves getting the cows from the corral to the milking parlor. The cows are herded from corral to milking parlor in a narrow walkway. This is done twice in a 24-hour period. The cows to be milked wait outside the parlor in another corral. Thirty milking stalls are used; the automatic method is used. When one cow is finished being milked, it is released and another cow enters the milking barn. The men put on and release the milking tubes, wash down the cows, and apply iodine to the cows' udders before the cows are returned to the corral. The milk travels through pipes from the udders into a large milk tank in another room. The milk is cooled in a holding tank to 50^{0}.

REGULATIONS AND PRICING

Ed Machado contracts to the Foremost Diary for 2,500 pounds of milk a day. Any milk produced over this amount is sold at a lower price. As mentioned before, the milk must be cooled to 50^{0} to be Grade A milk; milk cooled above that temperature is considered Grade B milk. The milk is tested, and if any forms of bacteria are present the milk is rejected. Ed Machado has each cow's progress computed daily.

ACTIVITIES

1. Trace on a bulletin board the various steps that milk takes from the cow to your table.

2. Draw pictures about your experience.

3. Research the regulations associated with the dairy industry.

4. Compute how many people get their milk from Machado's Dairy.

5. Make butter or cheese in the classroom. Ice cream could also be made.

6. Research the different breeds of dairy cows. Machado's herd could be researched.

7. Describe or write a story about a typical day at the dairy.

ADDITIONAL FIELD TRIPS

ALAMEDA COUNTY

Children's Adventure Garden, Blake Garden, University of California

Vallejo Flour Mill (1853), north of Niles Canyon Road, Niles

Holly Sugar Factory, H Street, Alvarado (older section of Niles)

Leland Stanford Winery (1869), Holy Name Road, Mission San Jose

Urban Integral House, Berkeley

CONTRA COSTA COUNTY

John Muir Home 4440 Alhambra Avenue, Martinez, National Historic Park

STANISLAUS COUNTY

Cheese Factory, Riverbank

Almond Grower's Association Outlet, Turlock

SANTA CLARA COUNTY

Hidden Villa Ranch, Los Altos

Deer Hollow Farm, Los Altos (contact: Mountain View Parks and Recreation, Linda Newberry)

Ecology Action, 2225 El Camino Real, Palo Alto (offers a textbook, free guided tours, free courses, and monthly newsletter)

Toris Jaeger

GLOSSARY OF AGRICULTURAL TERMS

GLOSSARY OF AGRICULTURAL TERMS

acre	4840 square yards
agriculture	Farming
agroecosystem	The managed environment
alfalfa	Medicago sativa, grown for hay and pasture
breed true	To reproduce the visible characteristics in successive generations
buck	Male goat
bushel	A measure of volume equal to 32 quarts
butterfat content	The amount of pure milk fat present in the milk
candling	A process by which the contents of an egg are examined
chex	Eggs that are thin-shelled or imperfectly shaped
compost	Decaying organic matter
crop rotation	The method by which a series of crops is grown in successive years on a particular plot of land
dairying	Industry producing milk and milk products
disking	A method for turning over soil
domesticate	To change the living habits of a plant or animal to such an extent that it serves, and is controlled by, man
fertilizer	A plant nutrient; can be in the form of plant or animal wastes or in chemical form
grafting	Method of propagation in which two parts of closely related plants are united so that they grow as one
harvest	The gathering of a crop
hybrid	An offspring of two animals or plants of different breeds, varieties, etc.
irrigation	The technique of spreading water over the land (as by canals, ditches, pipes, sprinklers, or flooding) to supply crop needs

kid	Immature goat
laying formula	Feed designed to allow chickens to lay to their fullest capacity
layers	Chickens bred for the purpose of laying eggs
leach	To subject to the action of percolating water or other liquid to separate the soluble components
levee	An embankment along a river to keep high waters from flooding the adjacent plain
limestone	Sedimentary rock composed wholly or in part of calcium carbonate
milking parlour	An area set aside for the milking of animals
monocrop agriculture	The extensive planting of one crop only, which allows the farmer to invest heavily in farm equipment designed for use with that crop
nanny	Female goat
orchard	A planting of fruit or nut trees
pest eradication	The removal of insects and rodents that compete with the farmer for the crops
phosphorus	A chemical (P) of the nitrogen family which is one of the major essential fertilizer elements
self-sufficient farming	The method of farming by which the farmer attempts to fill his needs with the things he produces himself
silo	A tall, hollow tower for the storage of grains
surplus	The amount of farm produce grown by a farmer over and above his own needs, on which civilizations and governments have risen and fallen
vaccinate	To use immunizing agents

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Anna McGuire